UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

IN RE GOOGLE PLAY STORE ANTITRUST LITIGATION

THIS DOCUMENT RELATES TO:

Epic Games, Inc. v. Google LLC et al., Case No. 3:20-cv-05671-JD

Case No. 3:20-CV-05671-JD
Case No. 3:21-MD-02981-JD

DECLARATION OF STEVEN TADELIS IN SUPPORT OF PLAINTIFF EPIC GAMES, INC.'S MOTION FOR A PRELIMINARY INJUNCTION

Date: June 2, 2022 at 10:00 a.m.
Courtroom: 11, 19th Floor
Judge: Hon. James Donato

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I, Steven Tadelis, declare as follows:

I. Introduction

A. Credentials

1. I am Professor of Economics, Business, and Public Policy and Sarin Chair in Strategy and Leadership at the Haas School of Business at the University of California at Berkeley. From 2006 until 2009, I was Associate Dean of Strategic Planning at the Haas School. Previously, I was Assistant Professor of Economics at Stanford University and have held visiting professorships at the Columbia University Graduate School of Business, the MIT Sloan School of Management, and Arizona State University.

2. I earned a Ph.D. in economics from Harvard University, a M.Sc. with special honors in economics from the Technion in Haifa, Israel, and a B.A. with special honors in economics from the University of Haifa. My research primarily revolves around e-commerce and the economics of the internet. I have published over three dozen articles in peer-reviewed journals and invited volumes in disciplines including economics, management, engineering, and computer science. I am also the author of an introductory game theory textbook published by Princeton University Press. In addition to my scholarly research, during two periods of academic leave totaling three years, I led teams of economists and other scientists at Amazon and eBay in applying economic research tools to understanding and improving the functioning of online marketplaces.

3. In both my academic research and my work with large technology companies, I have studied topics such as how to increase efficiency, safety, and trust in online marketplaces, and how to price goods and services in the context of e-commerce. My research often involves online "platforms," which economists refer to as "multisided markets." My work leverages economic theory and detailed data sets from technology companies to understand how these companies compete with one another, and how they monetize their products and services. For example, I have conducted research using data from online marketplaces like eBay and Taobao to understand when platforms' profit incentives are aligned with their users' incentives, and when these incentives can become misaligned. I have also studied how technology companies control the flow of information to their consumers to maximize

profit; in a recent article, I found that e-commerce companies obfuscate the fees they charge for their services, resulting in consumers buying more, and at higher prices, than they would if fees were more transparent.

4. I was elected a Fellow of the Econometric Society in 2020. I am also a Research Network Fellow of the Center for Economic Studies, ifo Institute, a Research Fellow of the Centre for Economic Policy Research, and a Research Associate of the National Bureau of Economic Research. I am past co-editor of the *Journal of Law, Economics and Organization* and have served on the editorial boards of the *California Management Review*, *American Economic Review*, and *International Journal of Industrial Organization*. I am currently Associate Editor of *American Economic Journal: Microeconomics*. I was a member of the scientific program committees of the 2014, 2016, 2017, 2019, and 2022 editions of the Association of Computing Machinery Conference on Economics and Computation, the leading scientific conference devoted to the intersection of economics and computation. In addition, I served on the scientific program committee for the 24th International World Wide Web Conference.

5. I have been hired to serve as an expert witness on a number of litigation matters. I have provided consulting support to the Federal Trade Commission and the Canadian Competition Bureau in consumer protection cases. Separately, I recently testified in a Canadian matter involving an intellectual property dispute.

B. Assignment

6. Counsel for Epic Games, Inc. ("Epic") asked me to address the following questions related to Epic's motion for a preliminary injunction:

i. Does Google have monopoly power in an antitrust market for app distribution on Android smartphones?

ii. Are in-app payment solutions a separate product from app distribution?

iii. Does Google's tie between app distribution and in-app payments foreclose competition in an antitrust market for in-app payment solutions for Android smartphones?

iv. Does Google's conduct result in anticompetitive effects in the markets for app distribution and in-app payments on Android smartphones?

7. This declaration explains my basis for answering these questions affirmatively. I have sought to do so succinctly by focusing on the key considerations. In preparing this declaration, I have relied on my general expert knowledge as an economist and my experience in antitrust work. I, and my staff from Bates White Economic Consulting and the Brattle Group at my direction, have also undertaken a preliminary review of data, documents, and depositions in this case, as well as public sources. The complete list of data, materials, and other information that I have relied upon in preparing this declaration is presented in Appendix B.

8. A copy of my curriculum vitae, which includes a list of all matters on which I have provided expert testimony within the past four years and a list of all publications I have authored in the past 10 years, is attached as Appendix C. I am being compensated for my time in this matter at my standard rate of $1,100 per hour. Additional Brattle and Bates White staff billed time for supporting me at rates ranging from $365 to $975 per hour. No compensation is contingent upon the outcome of this preliminary injunction motion.

9. The opinions expressed in this declaration are based on information available to me at this time. I am offering the opinions in this declaration solely in connection with Epic's motion for a preliminary injunction. I reserve the right to revise or supplement my opinion if any additional information makes that appropriate, to respond to any opinions offered by Google or its experts retained in this litigation, or to correct any inadvertent errors. My work in this matter is ongoing, and I reserve the right to address these or other issues, or to amend or supplement these opinions, at later stages of this litigation.

II. The Market for App Distribution on Android Smartphones Is a Relevant Product Market

10. In analyzing the competitive effects of Google's conduct, I identify two relevant antitrust markets that are useful for assessing Google's behavior. This section outlines the economic principles that guide my analysis of relevant markets and their application to the market for app

distribution on Android smartphones. In Section V, I apply these principles to the market for in-app payment solutions for Android smartphones.

A. Background

(1) Smartphones and mobile operating systems

11. Smartphones are mobile computing and telephone devices with cellular and Wi-Fi connectivity that provide consumers with wide functionality using application software ("apps"), often provided by third-party software developers. They are differentiated on a variety of dimensions, including price, hardware features (e.g., screen size and resolution, processing power, battery life, and camera features) and software features.[1]

12. Smartphones include a mobile operating system ("OS") that comes as preinstalled system-level software on smartphones. The smartphone's OS manages both the user-facing software and the hardware. It determines and controls a range of features, including the device's speed, technical performance, security, and what kinds of software and apps that can run on the smartphone.[2]

[1] Simon Hill and Jackie Dove, "How to choose a smartphone by brand, carrier, or features," DigitalTrends, updated March 24, 2021, https://www.digitaltrends.com/mobile/cell-phone-buying-guide/; Kelvin Wireko, "Difference Between A Smartphone, Android and iPhone in 2022," Tech Consumer Guide, updated April 5, 2022, https://www.techconsumerguide.com/differences-between-a-smartphone-android-and-iphone/.

Tablets are differentiated from smartphones by typically having a larger screen size and often lacking built-in cellular data access; they also frequently lack mobile phone capabilities such as SMS and voice calls. These factors make tablets less mobile than smartphones and less suited for certain applications and use cases. *See* Lauren Corona, "Tablet vs. phone: which is right for you?" Chicago Tribune, updated March 2, 2021, https://www.chicagotribune.com/consumer-reviews/sns-bestreviews-tech-tablet-vs-phone-20210302-e5zpsb7bkzag5d6l5okhdbirjm-story.html.

[2] *See* Ovidiu Constantin Novac, et. al., "Comparative Study of Google Android, Apple iOS and Microsoft Windows Phone Mobile Operating Systems," *2017 14th International Conference on Engineering of Modern Electric Systems (EMES)* (June 2017): 154–159, doi: 10.1109/EMES.2017.7980403. https://picture.iczhiku.com/resource/paper/WYKdfYhJZoaFHxXm.pdf

(2) App distribution services

13. A mobile app is a software application designed to run on a smartphone or tablet.[3] On Android smartphones, users can obtain mobile apps in two ways:[4]

i. Direct downloading (i.e., downloading a native app from a website)

ii. Intermediated distribution (i.e., "app stores")[5]

14. In direct downloading, also referred to as "direct distribution" or pejoratively referred to as "sideloading,"[6] a user downloads an app to a mobile device directly from a developer's website.[7]

15. The vast majority of Android apps are distributed via intermediated distribution. In intermediated distribution, consumers obtain the app from the developer indirectly, via an intermediary that operates an access point, such as a virtual storefront or marketplace ("app store"). In practice, to reach the broadest possible audience, developers distribute their apps through an app store.[8]

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[3] "Mobile Application (Mobile App)," Techopedia, updated August 7, 2020, https://www.techopedia.com/definition/2953/mobile-application-mobile-app. Apps can be: (i) "native," meaning they are hosted on and use the resources of the specific device and its OS; or (ii) web-based, which run through browser software. Native apps often outperform web apps because they can take advantage of the particular capabilities of the device and OS, and they rely less on data transfers between the device and the web, which can negatively impact app performance. Throughout this report, I use the term "mobile app" to refer to native apps exclusively.

[4] Mosk. Decl., Ex. 95, "Alternative distribution options," Android for Developers, accessed April 21, 2022, https://developer.android.com/distribute/marketing-tools/alternative-distribution. A phone manufacturer, or Original Equipment Manufacturer ("OEM"), will often preinstall selected apps on the device so that they are ready for use "out of the box," a practice referred to as "preloading." *See* "Preloaded Apps," ironSource, accessed April 21, 2022, https://www.is.com/glossary/preloaded-apps/.

[5] Examples of available app stores on Android smartphones include Google's Google Play and Samsung's Galaxy Store. *See* "Google Play," Google, accessed April 12, 2022, https://play.google.com/store?hl=en_US&gl=US; "Galaxy Store," Samsung, accessed April 12, 2022, https://www.samsung.com/us/apps/galaxy-store/. Some third-party app stores, such as Amazon's Appstore, are available for users to directly download but therefore require users to overcome the frictions imposed by Google, as described in Section III.B below. "Appstore for Android," Amazon, accessed April 12, 2022, https://www.amazon.com/gp/browse.html?node=2350149011&ref_=appstore_categorynav0.

[6] "Sideloading" suggests that direct downloading bypasses a "sanctioned" distribution channel. *See, e.g.*, "Sideload," PC Magazine, accessed April 21, 2022, https://www.pcmag.com/encyclopedia/term/sideload.

[7] Mosk. Decl., Ex. 95, "Alternative distribution options," Android for Developers, accessed April 21, 2022, https://developer.android.com/distribute/marketing-tools/alternative-distribution.

[8] See the discussion in Section III.B and on Google's "Android for Developers" website. Mosk. Decl., Ex. 95, "Alternative distribution options," Android for Developers, accessed April 21, 2022, https://developer.android.com/distribute/marketing-tools/alternative-distribution.

16. App distribution intermediaries may create value for both the app developer and the end user, for example, by facilitating "app discovery," a process whereby users learn about the functionality and quality of available apps in order to help determine which apps they might want to download.[9] An app distributor may facilitate app discovery by providing a familiar interface whereby different developers' offerings can be found and compared. The distributor may further aid discovery through features such as search filters, rankings, and user-generated reviews.[10] In economic terms, app discovery services reduce "search frictions," which are a special category of "transaction costs," or impediments to transacting.[11]

17. Though they can reduce some costs of bringing apps to market, distribution intermediaries may impose costs on users (end consumers) and developers of their services. For example, Android app stores—including the one operated by Google—often charge developers for their services, which they typically collect as a percentage of the developers' retail prices.

(3) Google Play Store

18. The Google Play Store ("Google Play"), formerly known as Android Market, is Google's proprietary app store developed for use with Android devices. Google monetizes its app store by charging a commission rate to the developer for sales of digital goods, including (i) the initial sale of the app through a single purchase or through a subscription and (ii) sales of digital content and

[9] Mosk. Decl., Ex. 97, "App Discovery and Ranking," Play Console Help, accessed April 21, 2022, https://support.google.com/googleplay/android-developer/answer/9958766?hl=en. A report by The Netherlands Authority for Consumers and Markets identifies reaching an audience as the biggest challenge for content (including app) providers. *See* The Netherlands Authority for Consumers & Markets, "Market study into mobile app stores," updated April 11, 2019, at 40, https://www.acm.nl/sites/default/files/documents/market-study-into-mobile-app-stores.pdf.

[10] Mosk. Decl., Ex. 79, Tom Grinsted, Scott Lin, and Tat Yang Koh, "Making Ratings and Reviews better for users and developers," Android Developers Blog, updated August 23, 2021, https://android-developers.googleblog.com/2021/08/making-ratings-and-reviews-better-for.html.

[11] Search frictions are "impediments to trade…Buyers may have trouble finding the goods they are looking for and sellers may not be able to find buyers for the goods they have to offer." "Markets with Search Frictions," The Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, updated October 11, 2010, https://www.nobelprize.org/uploads/2018/06/advanced-economicsciences2010.pdf. A "transaction" need not include a monetary exchange – for example, downloading a free app would be considered a "transaction." In addition, "transaction costs" need not be monetary, and can include time or hassle costs.

goods made within the app ("in-app purchases")[12], as well as by charging developers for advertising their apps within the store.[13] Historically, Google Play's headline commission rate on sales of all digital goods was 30%. [redacted][14] On October 20, 2017, Google announced a change that reduced the headline rate for subscriptions from 30% to 15% after the first year, but kept the rate at 30% for one-off (non-subscription) sales as well as for subscriptions during their first year.[15] On March 16, 2021, Google announced that for the first $1 million in revenue that developers earn, it would reduce the headline rate on all transactions to 15%.[16] Most recently, on October 21, 2021, Google announced that it would reduce the headline rate to a flat 15% rate for subscriptions.[17] Thus, today, Google's headline commission rate is 15% for the first $1 million in sales and 30% thereafter, or 15% for subscriptions, regardless of total subscription revenues.

B. Principles of market definition

19. A market is "an arrangement whereby buyers and sellers interact to determine the prices and quantities of a commodity."[18] Market definition in antitrust is a means by which practitioners identify a group of products that exercise competitive constraints on one another. Gregory Werden, former Senior Economic Counsel in the U.S. Department of Justice's ("DOJ's") Antitrust Division,

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[12] Mosk. Decl., Ex. 96, "Payments," Play Console Help, accessed April 21, 2022 [hereinafter, "Google Play Payments Policy"], https://support.google.com/googleplay/android-developer/answer/9858738.

[13] Mosk. Decl., Ex. 73.

[14] Mosk. Decl., Ex. 37 at -5552; Mosk. Decl., 47 at -6631([redacted]).

[15] Gadgets 360 Staff, "Google Play Lowers App Subscription Fee to 15 Percent, Matches Apple's Offering," Gadgets 360, updated October 20, 2017, https://gadgets.ndtv.com/apps/news/google-play-app-subscription-fee-30-percent-to-15-1764923.

[16] Mosk. Decl., Ex. 72, Sameer Samat, "Boosting developer success on Google Play," Android Developers Blog, updated March 16, 2021, https://android-developers.googleblog.com/2021/03/boosting-dev-success.html.

[17] Mosk. Decl., Ex. 77, Sameer Samat, "Evolving our business model to address developer needs," Android Developers Blog, updated October 21, 2021, https://android-developers.googleblog.com/2021/10/evolving-business-model.html. Developers can "offer in-app products that charge users for content or services on a recurring basis, known as subscriptions. Subscriptions can include items like a collection of apps, games, or other content for a recurring fee within your app on Google Play." Mosk. Decl., Ex. 98, "Create a subscription," Play Console Help, accessed April 23, 2022, https://support.google.com/googleplay/android-developer/answer/140504.

[18] Paul A. Samuelson and William D. Nordhaus, *Economics*, 16th ed., (McGraw-Hill, 1998), 750.

describes the use of market definition in antitrust as follows: "Market delineation in antitrust is a means to an end rather than an end in itself. Markets are tools used to aid in the assessment of market power-related issues."[19] Similarly, the DOJ and the Federal Trade Commission (collectively, "the Agencies") have stated that a relevant market must contain enough substitute products such that it could be subject to an exercise of market power.[20]

20. As an economic matter, the exercise of market power is generally frustrated by the widespread availability of substitutes. Indeed, economists define a perfectly competitive market (the opposite of a monopolized one) in part by the presence of many firms selling identical goods and where firms can enter and exit the market freely.[21] Thus, the essence of market definition is to identify reasonably interchangeable substitutes for the product(s) of interest that would defeat a prospective monopolist's attempt to raise prices above a competitive benchmark.

21. One tool for market definition is the Hypothetical Monopolist Test ("HMT"), contained in the Agencies' Horizontal Merger Guidelines:

> The hypothetical monopolist test requires that a product market contain enough substitute products so that it could be subject to post-merger exercise of market power significantly exceeding that existing absent the merger. Specifically, the test requires that a hypothetical profit-maximizing firm, not subject to price regulation, that was the only present and future seller of those products ("hypothetical monopolist") likely would impose at least a small but significant and non-transitory increase in price ("SSNIP") on at least one product in the market, including at least one product sold by one of the merging firms.[22]

22. The Horizontal Merger Guidelines clarify that "[m]arket definition focuses solely on demand substitution factors, i.e., on customers' ability and willingness to substitute away from one product to another in response to a price increase or a corresponding non-price change such as a

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[19] Gregory Werden, "Four Suggestions on Market Delineation," *Antitrust Bulletin* 37, no. 1 (March 1992): 108.

[20] U.S. Department of Justice and the Federal Trade Commission, "Horizontal Merger Guidelines," updated August 19, 2010 [hereinafter, "Horizontal Merger Guidelines 2010"], at § 4.11, https://www.justice.gov/atr/horizontal-merger-guidelines-08192010.

[21] Dennis W. Carlton and Jeffrey M. Perloff, Modern Industrial Organization, 4th ed. (Boston: Pearson Addison Wesley, 2005), 56–64.

[22] Horizontal Merger Guidelines 2010, at § 4.1.

reduction in product quality or service."[23] The conceptual exercise of market definition frames the evaluation of market characteristics pertinent to an antitrust analysis , such as market shares, entry conditions, and supply substitution (e.g., reallocation or creation of production capacity that might satisfy consumers' demand for substitutes and thereby discipline market power).[24]

23. The HMT is not always (or even ordinarily) applied quantitatively. As the Horizontal Merger Guidelines describe:

> Even when the evidence necessary to perform the hypothetical monopolist test quantitatively is not available, the conceptual framework of the test provides a useful methodological tool for gathering and analyzing evidence pertinent to customer substitution and to market definition. The Agencies follow the hypothetical monopolist test to the extent possible given the available evidence, bearing in mind that the ultimate goal of market definition is to help determine whether the merger may substantially lessen competition.[25]

24. The reference to a "merger" is important. Application of the HMT in a single-firm conduct case such as the present matter, where anticompetitive conduct is alleged already to have occurred, is complicated by the fact that the HMT is a prospective test that was originally developed for merger analysis. The concern in merger analysis is to determine whether a proposed merger would lead to a significant reduction in competition and an increase in pricing power.[26] Hence, the baseline for the SSNIP test envisioned by the HMT is the pre-merger price—i.e., the price in the market's more-competitive state.[27] In a market that is already monopolized, e.g., as a result of anticompetitive conduct, a literal application of the SSNIP test could be misleading, because a dominant firm may have already used its market power (either legitimate or illegitimate) to set the market price above a competitive level. Consequently, an increase beyond this level (such as the SSNIP proposed by the

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[23] Horizontal Merger Guidelines 2010, at § 4.

[24] Horizontal Merger Guidelines 2010, at § 4; Jonathan B. Baker, "Market Definition: An Analytical Overview," *Antitrust Law Journal* 74, no. 1 (2007): 134.

[25] Horizontal Merger Guidelines 2010, at § 4.

[26] *See, e.g.*, Gregory J. Werden, "Market Delineation under the Merger Guidelines: Monopoly Cases and Alternative Approaches," *Review of Industrial Organization* 16, no. 2 (2000): 212.

[27] *See* Horizontal Merger Guidelines 2010, at § 4.1.2 ("The Agencies apply the SSNIP starting from prices that would likely prevail absent the merger. If prices are not likely to change absent the merger, these benchmark prices can reasonably be taken to be the prices prevailing prior to the merger […]. If prices might fall absent the merger due to the breakdown of pre-merger coordination, the Agencies may use those lower prices as the benchmark for the test.").

HMT) could result in increased levels of substitution above what would result at a lower, competitive starting price, and the HMT would incorrectly suggest that the market is not monopolized and should be more broadly defined.[28]

25. In intuitive terms, guidance from the Agencies on market definition amounts to asking the following question: "Where could customers reasonably turn to avoid trading with a monopolist on its terms?" My analysis below, which focuses on Android smartphone users' and developers' access to reasonably interchangeable substitutes for Google's products at issue, is consistent with this guidance.

26. Finally, according to the U.S. Supreme Court's opinion in *Brown Shoe*, a relevant market can be defined on the basis of "practical indicia," including industry or public recognition of the market as a separate economic entity, the product's peculiar characteristics and uses, unique production facilities, distinct customers, distinct prices, sensitivity to price changes, and specialized vendors.[29] Like the HMT, these factors can assist in identifying reasonably interchangeable substitutes for the products at issue.

C. Users and developers have limited ability to substitute away from app distribution on Android smartphones in the face of an exercise of market power

27. App distribution on Android smartphones facilitates the delivery of developers' apps to Android smartphone users. Thus the "customers" of app distribution services on Android smartphones includes both (a) end consumers who are users of Android smartphones seeking to obtain apps and (b) app developers seeking to distribute their Android apps to users' Android smartphones. In this section, I consider whether these users or developers could switch to app distribution on iOS smartphones or app distribution on non-smartphone devices to defeat an exercise of market power by a hypothetical monopolist in the market for app distribution on Android smartphones. I conclude that such alternatives do not provide reasonably interchangeable substitutes for Google's products at issue that would defeat an exercise of market power in app distribution on Android smartphones.

[28] This is a version of the so-called "Cellophane Fallacy." *See, e.g.*, Jonathan B. Baker, "Market Definition: An Analytical Overview," *Antitrust Law Journal* 74, no. 1 (2007): 162-165.

[29] Brown Shoe Co. v. United States, 370 U.S. 294, 325 (1962).

(1) There is limited consumer substitution between app distribution on Android and iOS smartphones

28. Although developers may make their apps available on multiple devices and platforms to reach additional consumers, apps must be developed for each device's OS and must be distributed to each specific device. As a result, consumers can only switch away from app distribution on Android smartphones by switching to using that app, or a similar app, on a different device. In theory, an avenue for users to defeat the exercise of market power in the market for app distribution on Android smartphones is for consumers to switch in sufficient numbers to iPhones, where a similar array of apps is available as on Android smartphones. However, (i) consumer substitution from Android smartphones to iPhones faces substantial frictions, and (ii) a SSNIP in app distribution is small compared to the costs of purchasing a new smartphone, including both financial costs and other costs such as learning to use a new OS. Hence, a SSNIP in the price of app distribution on Android smartphones would result in insufficient consumer switching to iPhones to make the price increase unprofitable.

29. Market evidence shows that the Android and iOS ecosystems are highly differentiated, offering consumers smartphones and associated mobile OSs with different characteristics and different price points. Competition between Apple, on the one hand, and Android smartphone manufacturers, on the other hand, is muted by price and feature differences between Apple iPhones and Android smartphones, resulting in a significant degree of ecosystem lock-in that creates high switching costs in moving across the two ecosystems.

30. iPhones are generally higher-end, more expensive smartphones than Android smartphones.[30] This difference is in part due to variation across devices within each OS. On the one hand, Android runs on a larger variety of phones, from higher-end devices such as the Samsung

[30] For consumers who choose Android, the price range is more accessible to everyone. *See* Jordan Palmer, "iPhone vs. Android: Which is better for you?" Toms Guide, updated March 29, 2022, https://www.tomsguide.com/face-off/iphone-vs-android. ("No matter how much you can spend, chances are you can find an Android device that fits your budget or offers exclusive features. The same cannot be said for iPhones, which historically have been expensive at launch, only to come down in price after successive generations.")

Galaxy S22 ($999 MSRP) to lower-end smartphones such as the LG K22 ($89.99 MSRP).[31] On the other hand, iOS exclusively powers iPhones, such as the iPhone 13, that can cost more than $1,000 on the higher-end and the iPhone SE ($399 MSRP) on the lower-end.[32] The global average price of iPhones was approximately $821 in 2021,[33] whereas the average sales price of Android smartphones worldwide was $261 in 2021.[34]

31. In addition to price, consumers consider a wide range of differentiating characteristics when comparing smartphones, including hardware, interface and usability, technical support, security and privacy, integration with desktop and other devices, camera and photos, battery life, and voice assistant.[35] Since Android and Apple smartphones are differentiated on price and features, they typically appeal to different consumers. Moreover, very few consumers use both an Android and an iOS smartphone.[36]

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[31] Lisa Eadicicco, "Samsung Galaxy S22 Plus Review: Samsung's Middle Child May Be My Favorite," updated February 17, 2022, https://www.cnet.com/tech/mobile/samsung-galaxy-s22-plus-review-samsungs-middle-child-may-be-our-favorite/; Corbin Davenport, "LG K22 review: A good phone for the price of a PS5 game," Android Police, updated January 30, 2021, androidpolice.com/2021/01/30/lg-k22-review-better-than-i-was-expecting-for-70/

[32] Joan E. Solsman, "iPhone 13 Pro line finally gets 1TB of storage, creating the most expensive iPhone ever," updated September 15, 2021, https://www.cnet.com/tech/mobile/iphone-13-pro-line-finally-gets-1tb-of-storage-creating-the-most-expensive-iphone-ever/; Dieter Bohn, "Apple iPhone SE Review: Everything You Need," updated April 22, 2020, https://www.theverge.com/2020/4/22/21230308/apple-iphone-se-2-2020-review-features-specs-camera-price.

[33] There were 234 million iPhones sold globally in 2021, and the total global revenue for iPhones sold in 2021 was $192 billion. $192 $billion/0.234$ $billion = $820.5. *See* IDC, "Apple worldwide shipments of smartphones from 2010 to 2021 (in million units), by quarter," accessed April 13, 2022, Statista, https://www.statista.com/statistics/299153/apple-smartphone-shipments-worldwide/; Apple, "Apple's iPhone revenue from 3rd quarter 2007 to 1st quarter 2022 (in million U.S. dollars)," Statista, accessed April 13, 2022, https://www.statista.com/statistics/263402/apples-iphone-revenue-since-3rd-quarter-2007/.

[34] *See* IDC, "Average selling price (ASP) of Android smartphones worldwide from 2017 to 2021 (in U.S. dollars)," Statista, accessed April 19, 2022, https://www.statista.com/statistics/951537/worldwide-average-selling-price-android-smartphones/

[35] *See, e.g.,*Michael Muchmore, "Android vs. iOS: Which Mobile OS Is Best?," PC Mag, updated October 2, 2022, https://www.pcmag.com/comparisons/android-vs-ios-which-mobile-os-is-best; Sam Costello, "iPhone vs Android: Which Is Better For You?," Lifewire, updated November 22. 2021, https://www.lifewire.com/iphone-vs-android-best-smartphone-2000309.

[36] "Digital platform services inquiry: Interim report No.2 – App marketplaces," Australian Competition & Consumer Commission, updated March 2021 [hereinafter, "ACCC inquiry"], at 34 ("Given the cost of owning multiple mobile devices and the inconvenience of operating across multiple OS, most consumers single-home. That is, they own an Apple mobile device or an Android mobile device, but not both. This is particularly the case for smartphones.").

32. There are also substantial switching costs involved in moving between Android and iOS smartphones; these include the:

i. [redacted],[37]

ii. financial cost of re-purchasing apps and in-app purchases for the new platform,[38]

iii. [redacted],[39] and

iv. [redacted].[40]

33. Indeed, actual switching rates between iOS and Android are low for consumers purchasing a new smartphone. Because users purchase a new smartphone around every two to three years,[41] about 40 percent of users buy a new phone every year. [redacted].[42] This implies that only about [redacted] percent of current users will switch to a different OS each year.

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[37] *See, e.g.*, Mosk. Decl., Ex. 23 at -0613–15, 0625-30 [redacted] Lukasz Grzybowski and Ambre Nicolle, "Estimating Consumer Inertia in Repeated Choices of Smartphones," *Journal of Industrial Economics* 69, no. 1 (March 2021) [hereinafter, "Grzybowski and Nicolle 2021"]: 33, 50-51 (finding significant monetary switching cost in terms of willingness to pay, calculated as 520€ (between 391€ and 441€ for Android-to-iOS, 445€ and 833€ for iOS-to-Android)).

[38] JR Raphael, "iPhone to Android: The ultimate switching guide," Computerworld, updated February 7, 2020, https://www.computerworld.com/article/3218067/how-to-switch-from-iphone-to-android-ultimate-guide.html. ("The bad news: any apps you've installed on your iPhone won't automatically transfer over to Android, and any apps you've paid for on iOS will have to be purchased again.").

[39] [redacted] Mosk. Decl., Ex. 15 at -2119. When users switch, they incur the cost of switching away from the entire phone ecosystem (e.g., iPhone, iPad, and Macs are compatible with one another) Grzybowski and Nicolle 2021, at 50–51.

[40] Mosk. Decl., Ex. 33 at -6817 ([redacted]).

[41] Daniel Research Group, "Average lifespan (replacement cycle length) of smartphones in the United States from 2014 to 2025," Statista, updated September 2021. https://www.statista.com/statistics/619788/average-smartphone-life/.

[42] [redacted] Mosk. Decl., Ex. 25 at -8919.

34. In addition to these low switching rates, consumer spending on apps is small compared to the cost of a new smartphone. As an illustrative back-of-the-envelope calculation, on average, Android smartphone users spent about $11 on app-related purchases in Google Play in 2021.[43] A 10% increase in Google's 30% headline commission rate on this $11 would represent an increase of at most 33 cents for the cost of app distribution per year for the average Android consumer, assuming all of the developers' price increase was passed directly to consumers. This amount is small compared with either the global average price of iPhones, which was approximately $821 in 2021,[44] or with the added cost to buy an iPhone rather than an Android smartphone, which was, based on average sales prices, $560 in 2021.[45] Because a SSNIP in app distribution on Android smartphones would be minimal when compared to the costs of switching smartphone ecosystems and when compared to the relative import of other non-app distribution related smartphone characteristics, substitution by consumers to iPhones would not discipline a hypothetical monopolist in Android app distribution.

[43] Consumer spending in Google Play apps was $50 billion in 2021 worldwide. In 2021, the number of smartphone subscriptions (i.e., the number of phones registered with a carrier) worldwide was 6.2 billion and the share of Android OS was 72%. $\$11.20 = \$50\ billion/(6.2\ billion \times 72\%)$. *See* Stephanie Chan, "Mobile app consumer spending worldwide from 2020 to 2025, by store (in billion U.S. dollars)," Statista, February 22, 2021, updated February 2021, https://www.statista.com/statistics/747489/annual-consumer-spend-mobile-app-by-store/; Ericsson, "Number of smartphone subscriptions worldwide from 2016 to 2027 (in millions)," February 15, 2022, Statista, accessed April 13, 2022. https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/; StatCounter, "Mobile Operating System Market Share Worldwide," accessed April 13, 2022, https://gs.statcounter.com/os-market-share/mobile/worldwide/#yearly-2019-2022. There is, of course, variation in how much consumers spend per year on apps. For example, [redacted] Mosk. Decl., Ex. 29 at -2649.

[44] There were 234 million iPhones sold globally in 2021, and the total global revenue for iPhones sold in 2021 was $192 billion. $192\ billion/0.234\ billion = \$820.5$. *See* IDC, "Apple worldwide shipments of smartphones from 2010 to 2021 (in million units), by quarter," accessed April 13, 2022, Statista, https://www.statista.com/statistics/299153/apple-smartphone-shipments-worldwide/; Apple, "Apple's iPhone revenue from 3rd quarter 2007 to 1st quarter 2022 (in million U.S. dollars)," Statista, accessed April 13, 2022, https://www.statista.com/statistics/263402/apples-iphone-revenue-since-3rd-quarter-2007/.

[45] The average sales price of Android smartphones worldwide was $261 in 2021. Hence, the difference in the average prices between iPhones and Android smartphones was $\$821 - \$261 = \$560$ in 2021. *See* IDC, "Average selling price (ASP) of Android smartphones worldwide from 2017 to 2021 (in U.S. dollars)," Statista, accessed April 19, 2022, https://www.statista.com/statistics/951537/worldwide-average-selling-price-android-smartphones/

(2) There is limited consumer substitution between app distribution on Android smartphones and app distribution on non-smartphone devices

35. Another theoretical way for a SSNIP by a hypothetical monopolist to be unprofitable is for consumers to switch in sufficient numbers to app distribution, and hence app usage, on devices other than smartphones. As explained below, consumers do not view other devices as reasonable alternatives to their smartphones, and thus consumer substitution to such devices is limited.

36. Smartphones provide a unique, comprehensive set of consumer features—cellular connectivity for voice and data, size and portability, camera, touch screen, and a wide variety of entertainment, productivity, and other applications—that no other mobile or non-mobile device completely provides. For example, other mobile devices, such as feature phones and tablets, lack smartphones' combination of a wide app ecosystem, voice capabilities, cellular connectivity, and the small size that allows them to fit in a pocket and be comfortably used with one hand.[46] Today, smartphones have become a must-have product for the substantial majority of the world's population.[47]

37. App usage on smartphones is very different than app usage on other devices (PCs, consoles, and tablets).[48] In some cases, such as an app that provides turn-by-turn driving directions or

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[46] Smartphones have smaller screen sizes and cellular connectivity, enabling them to be used in a wider range of locations outside the house. In comparison, tablets are mostly used at home given their cumbersome size and lack of connectivity without cellular capabilities. "2015 Deconstructing mobile and tablet gaming," EEDAR 2015 Syndicated report - free version, accessed April 21, 2022, 17–18, https://progamedev.net/wp-content/uploads/2015/11/EEDAR_Mobile_Report_2015.pdf. [redacted]. Mosk. Decl., Ex. 20 at -2282, -2305–06.

Feature phones are limited in their ability to download and run high-end applications, though they are a cheaper option than smartphones. IDC, "Quarterly Mobile Phone Market Qualitative Analysis 3Q21: Asia/Pacific (Excluding Japan)," 2021, at 3; "Mobile phones, feature phones and smartphones: the differences," Microsoft Devices Blog, accessed April 21, 2022, https://blogs.windows.com/devices/2012/07/24/mobile-phones-feature-phones-and-smartphones-the-differences/.

[47] *See, e.g.*, United Nations, Statista, Ericsson, "Global smartphone penetration rate as share of population from 2016 to 2020," Statista, accessed April 19, 2022, https://www.statista.com/statistics/203734/global-smartphone-penetration-per-capita-since-2005/. The global smartphone penetration rate was 78% as of 2020, up from 49% in 2016.

[48] Most users access banking, navigation, weather applications, social media, and dating applications exclusively through mobile. "Mobile's Hierarchy of Needs," Comscore, updated April 5, 2017, at 19–28, https://www.comscore.com/Insights/Presentations-and-Whitepapers/2017/Mobiles-Hierarchy-of-Needs; Mosk. Decl., Ex. 20 at -2307.

an app that is "location-based",[49] the app or its core functionality is specific to a smartphone. In other cases, an app or type of app may exist on multiple devices but have different use cases across devices. For example, a game app on a smartphone may be a nice way to spend time while commuting to and from work, whereas playing a game—even the same game—at home on a game console provides a qualitatively different experience and level of engagement.

D. There is limited developer substitution between app distribution on Android smartphones and app distribution on iPhones and non-smartphone devices

38. App developers need to reach consumers to gain monetary returns from app development. Because consumer substitution (i) between Android smartphones and iPhones and (ii) between smartphones and non-smartphone devices is limited (*see* Sections (1) and C.34(2) above), and because consumers tend to use either an Android smartphone or an iPhone, but not both,[50]

"The portability of smartphones means that mobile gamers are better able to play their games when they are out of the house, particularly when traveling, waiting or during breaks from other activities," "Deconstructing Mobile and Tablet Gaming," EEDAR, 2014, at 18, https://designinggames.files.wordpress.com/2015/06/eedar_-_deconstructing_mobile_gaming_2014.pdf.

[redacted] Mosk. Decl., Ex. 57 at -4201–02.

Mobile gamers are more likely to play simpler, more mobile-friendly games (ex. strategy and puzzle games), whereas PC gamers are more likely to play more intensive games (ex. action, shooters). "Awesome Video Game Data," EEDAR, 2017, at 12, https://www.gdcvault.com/play/1024054/Awesome-Video-Game-Data.

[49] *See also* Deposition of Adrian Ong, Epic Games, Inc., v. Apple Inc., No. 4:20-cv-05640-YGR-TSH, (N.D. Cal. February 24, 2021) [hereinafter, "Deposition of Adrian Ong"], 12:24–13:25. ("Q. Are any of Match Group's dating service products available on gaming consoles, such as the Nintendo Switch, the Xbox or the PlayStation? A. Not that I'm aware of. Q. Okay. Why is that? A. It's—I just don't see it being a good fit...[W]e just find that...majority of the audience and distribution is on the mobile device. And so...most people have their mobile devices with them all the time, which means they're able to find matches anytime they want...Also, our apps are designed to be location-based...[I]t's not really convenient to carry your gaming console around with you.").

[50] ACCC inquiry, at 34 ("Consumers who wish to switch from using the [Google] Play Store to the [Apple] App Store must switch from using an Android mobile device to an Apple mobile device (for example, a smartphone or a tablet). Given the cost of owning multiple mobile devices and the inconvenience of operating across multiple OS, most consumers single-home. That is, they own an Apple mobile device or an Android mobile device, but not both. This is particularly the case for smartphones. An exception to this is consumers who have an Android smartphone and an Apple iPad or vice versa. These consumers can more readily switch between using the Play Store to the App Store without the need to purchase another device. While this is the case, the scope for this substitution is limited to circumstances where the consumer has easy access to both their smartphone and a tablet of the alternative mobile OS. Overall, it appears unlikely that the availability of the App Store to the relatively small number of multi-homing consumers would provide a competitive constraint on the Play Store.").

developers need to release apps on Android smartphones to effectively reach the three billion Android users worldwide.[51] In fact, the vast majority of top apps are available on both Android and iOS phones.[52] Because developers lack other effective means of reaching Android smartphone users, a SSNIP in app distribution on Android would not induce a sufficient number of developers to forego the Android ecosystem to discipline a hypothetical monopolist of the market.

39. Developers have indicated that they do not view app distribution on iOS as a substitute for app distribution on Android smartphones. For example:

- Mr. Ong, Senior Vice President of Operations at Match Group, testified that Android was not a substitute for iOS: "Q: Have you reached any conclusion about whether Android is a substitute for iOS for Match Group's products? A: It is not a substitute."[53]

- Mr. Simon, President and CEO of Down Dog, testified that "there is very little cross over Android and with iOS for any particular user. In our case specifically, we've grown almost entirely by word of mouth. We have done almost no marketing, which means users tell their friends and family about Down Dog. If half of their friends and family can't download Down Dog because they have an iOS device and not an Android, then that actually amounts to basically halving our growth rate, which is something that compounds over time. So it substantially reduces the ability for us to grow."[54]

- [redacted][55]

[51] Android has three billion users worldwide. Alex Cranz, "There are over 3 billion active Android devices," The Verge, updated May 18, 2021, https://www.theverge.com/2021/5/18/22440813/android-devices-active-number-smartphones-google-2021.

[52] According to AppFigures and Google Play's website, nearly all top free and paid apps available on iOS for iPhones in the U.S. are also available on Google Play. *See* "Top Ranked iOS App Store Apps," AppFigures, accessed April 14, 2022, https://appfigures.com/top-apps/ios-app-store/united-states/iphone/top-overall. "Apps," Google Play, accessed April 22, 2022, https://play.google.com/store/apps/?hl=en_US&gl=US.

[53] Mosk. Decl., Ex. 70, Deposition of Adrian Ong, 67:23–68:1.

[54] Mosk. Decl., Ex. 74, Trial Transcript, Epic Games, Inc., v. Apple Inc., No. 4:20-cv-05640-YGR-TSH, (N.D. Cal. May 4, 2021), 393:23–394:7.

[55] Mosk. Decl., Ex. 91, Deposition of [redacted], 283:13–287:14, February 10, 2022.

E. Regulatory authorities have corroborated the appropriateness of defining a market for app distribution on Android smartphones

40. Regulatory authorities around the world corroborate my assessment that app distribution on Android smartphones is not significantly constrained by Apple's App Store on iPhones or app distribution on other devices. For instance:

- A 2018 European Commission investigation into Google concluded that "Android app stores" constitute a separate relevant product market.[56]
- The U.S. House of Representatives Subcommittee on Antitrust, Commercial and Administrative Law in 2020 found that since iOS users cannot access Google Play and Android users cannot access the App Store, among other reasons, the two app stores do not constrain one another.[57]
- The Australian Competition & Consumer Commission (ACCC) concluded in an interim report that potential competitive constraints on Google Play, including via distribution on the App Store or non-mobile devices, are weak and thus "Google has market power in the distribution of mobile apps."[58]

[56] Commission Decision of 18.7.2018, Case AT.40099 – Google Android (July 18, 2018) [hereinafter, "EC decision"], at § 7.4. ("The Commission concludes that Android app stores constitute a separate relevant product market."). *See also* EC decision, at ¶ 303. ("HTC, Microsoft, Yandex and Nokia refer to the importance of user reach and that, as a result, app developers focus on the two largest app stores (Apple AppStore and the Play Store).").

[57] "Investigation of Competition in Digital Markets: Majority Staff Report and Recommendations," U.S. House of Representatives Subcommittee on Antritust, Commercial and Administrative Law of the Committee on the Judiciary, 2020, at 95. ("Android users cannot access the Apple App Store, and iOS users cannot access the Google Play Store, so the dominance of Google Play is not constrained by the App Store and vice versa.").

[58] ACCC inquiry, at 41 ("To the extent that there is any significant competitive constraint on the Play Store, it is likely to come from fixed devices or the App Store. For most activities, it does not appear that fixed devices and mobile apps are close substitutes. This includes activities such as gaming where consumers use both fixed devices and apps on mobile devices extensively. As a result, it does not appear, from the information available, that fixed devices impose a strong constraint on the Play Store. While the App Store may constrain the Play Store to a degree, from the information that is available, the constraint appears to be weak. For the majority of app developers, the App Store and the Play Store are not substitutes. Further, while consumers who are dissatisfied with the apps available through the Play Store have the option to switch to the App Store, such a switch is likely to be costly and hence unlikely. The lack of strong competitive constraints faced by the Play Store gives Google market power in the distribution of mobile apps. This market power particularly affects Google's dealings with app developers.").

III. Google Has Monopoly Power in the Market for App Distribution on Android Smartphones

A. The economics of market power

41. Economists define market power as the ability to profitably set a price above the competitive price, comparably degrade product quality, or exclude competition. A firm is said to possess monopoly power if it has substantial and sustained market power.[59] A firm with monopoly power is typically called a "monopolist," even if it is not a pure monopolist of the type described in introductory economic textbooks (i.e., with no competitors at all).

42. To determine the extent of any one firm's market power, economists rely on both indirect and direct evidence.[60] Indirect evidence of market power includes a high market share in a relevant antitrust market. Because the ability to raise quality-adjusted prices is often correlated with high market share, this evidence is frequently used as an indicator of market power.[61] Other indirect evidence of market power includes evidence of barriers to entry, which when coupled with high, sustained market shares, indicates the presence of substantial market power, i.e., monopoly power.

43. The most direct evidence of market power includes evidence of a firm raising quality-adjusted prices and sustaining profit margins above competitive levels for a prolonged period. Other direct evidence of market power includes a firm engaging in actions that would not be rational for a firm that lacks market power (e.g., the imposition of onerous non-price conditions on customers).

44. Lastly, it should be noted that evidence of the exercise of market power can itself be evidence of the existence of a relevant market.[62]

B. Evidence of Google's monopoly power in the market for app distribution on Android smartphones

45. In this section, I describe both indirect and direct evidence establishing that Google has monopoly power in the market for app distribution on Android smartphones. Indirect evidence

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[59] *See, e.g.*, Herbert Hovenkamp, *Federal Antitrust Policy: The Law of Competition and its Practice*, 2nd ed. (St. Paul, MN: West Group, 1999), 78.

[60] *See, e.g.,* Horizontal Merger Guidelines 2010, § 2.1.

[61] Horizontal Merger Guidelines 2010, §§ 2.1.3 and 5.

[62] Horizontal Merger Guidelines 2010, § 4 ("Evidence of competitive effects can inform market definition, just as market definition can be informative regarding competitive effects.").

includes Google's persistently high market shares in the market for app distribution on Android smartphones and high barriers to entry. Direct evidence includes Google's high prices and profits in the market for app distribution on Android smartphones.

(1) Indirect evidence of market power

(a) Google has persistently high market shares

46. Google has had a sustained dominant market share in the market for app distribution on Android smartphones, [redacted].[63] [redacted][64] Such a large share over a long period of time is a strong indication of Google's market power on its own.

47. Google's most notable competitors such as Samsung's Galaxy Store, Amazon's Appstore, Korea's ONE Store, and 9Apps all have vastly smaller market shares. For example, [redacted].[65] [redacted].[66] [redacted].[67]

(b) Barriers to entry are high

48. Google's high market shares are buttressed with significant barriers to entry for competing app stores that could discipline Google's market power. As described below, Google itself has erected a number of these barriers to entry in app distribution on Android smartphones through its

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[63] [redacted] Mosk. Decl., Ex. 64 at -9656–57.

[64] Mosk. Decl., Ex. 16 at -6112, 18; Mosk. Decl., Ex. 11.

[65] Mosk. Decl., Ex. 53 at -6229.

[66] Mosk. Decl., Ex. 28 at -6493–94.

[67] Mosk. Decl., Ex. 28 at -6493–94.

control of effectively the only smartphone OS available for licensing to smartphone manufacturers (OEMs) outside of China.[68]

49. [redacted].[69]

50. These restrictions include: (i) Google's contracts with OEMs and [redacted] requiring the preinstallation of Google Play on all Google Android smartphones in a favorable screen position;[70] (ii) Google's exclusivity agreements with OEMs restricting the incentive of OEMs to preinstall competing third-party app stores;[71] (iii) Google's technological barriers that increase the friction of using competing distribution methods by making it time consuming and seemingly dangerous for users to download apps directly from developer web sites or from third-party app

[68] Beginning in 2015, no mobile OS had any significant share of the worldwide market other than Android and iOS File name: "IDC_Quarterly_Mobile_Phone_Tracker_-Final_Historical_2021Q3_20220104_141230_363_714385.xlsx". Apple does not license its operating system to phone manufacturers, leaving Google's Android as the only viable option for OEMs to use to power their smartphone devices. *See* Mosk. Decl., Ex. 75, Trial Transcript, Epic Games, Inc., v. Apple Inc., No. 4:20-cv-05640-YGR-TSH, (N.D. Cal. May 4, 2021), 2723:18–21. (Philip Schiller, from Apple, testified in *Epic v. Apple*: "Q. ...And does Apple license iOS to third parties? A. No. Q. And why not? A. That's, you know, not the business we're in.").

[69] For example, [redacted] Mosk. Decl., Ex. 13 at -0006-08 (emphasis added).

[70] Mosk. Decl., Ex. 90, Deposition of [redacted], 92:20–93:6, February 2, 2022. Through its contracts with OEMs and carriers, Google impedes rival app stores from being prominently placed on smartphone home screens by requiring favored placement for Google's own apps (including Google Play) and requiring OEMs to preload a large number of Google applications that take up valuable real estate on users' devices. Mosk. Decl., Ex. 12 at -4060, 63; Mosk. Decl., Ex. 58.

[71] Starting in late 2019, Google executed contracts with most OEMs that include a "Premier Device Tier" [redacted] in return for preload exclusivity for Google Play and a number of other Google applications. [redacted] *See* Mosk. Decl., Ex. 58. [redacted] Mosk. Decl., Ex. 61 at -8465.

stores;[72] and (iv) the restriction in Google's Developer Policies that prohibits any app stores from being distributed through Google Play.[73]

51. In addition, [redacted].[74]

52. These restrictions, interacted with the network effects involved in app distribution, collectively limit the scale and effectiveness of competing app distribution channels. Network effects exist when someone benefits from others utilizing the same service, where such effects could be on the same side of the market (a user benefits from more users using the app, also known as "direct" network effects) or the other side of the market (a user benefits from more developers using the app store, also known as "indirect" network effects). In the case of Google Play and other app stores, developers benefit from the presence of additional users since those extra users provide additional sources of potential profit. Conversely, end users benefit from the presence of additional developers on the store since those extra developers offer additional apps that end users may find valuable. [redacted][75]

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[72] [redacted] Mosk. Decl., Ex. 26 at 7970. *See also* Mosk. Decl., Ex. 26 at -7951 [redacted]

[73] Mosk. Decl., Ex. 68.

[74] Google maintains several incentive programs for developers—Games Velocity Program (Project Hug) for game apps, [redacted] to encourage them to prioritize Google Play for distribution of their apps. [redacted] *See, e.g.,* Mosk. Decl., Ex. 59 at -9033; Mosk. Decl., Ex. 65 at -4492.

[75] Mosk. Decl., Ex. 14 at -0362.

[redacted][76]

53. Hence, a competing app store looking to compete successfully with Google Play would seek to leverage network effects to a similar extent. Insights into the extent of network effects are provided by the numbers of users and developers per Android app store: as of January 2017 there were 724,000 active mobile app developers (i.e., developers that had released an app) on Google Play, more than tenfold the 69,000 active mobile app developers on the Amazon Appstore.[77] A Google internal calculation from 2019 found that [redacted].[78]

54. The failed entry of Amazon is illustrative of the significant barriers to entry in the market for app distribution on Android smartphones. Amazon's Appstore was launched in 2011 and, despite Amazon's financial strength, technical capabilities, and pre-existing user base to potentially leverage network effects, the Amazon Appstore [redacted], compared to Google Play's approximately 3.5 million apps as of Q1 2021 and 2.5 billion monthly users as of July 2021.[79] Amazon's failure is not due to a lack of effort:

[redacted]

[76] Mosk. Decl., Ex. 26 at -7954. [redacted]

[77] Appfigures, "Total number of active mobile app developers in leading global app stores as of January 2017 (in 1,000s)," January 24, 2017, Statista, accessed April 22, 2022, https://www.statista.com/statistics/276437/developers-per-appstore/. [redacted]. Mosk. Decl., Ex. 26 at -7954 [redacted]

[78] Mosk. Decl., Ex. 53 at -6229.

[79] Appfigures, und VentureBeat, "Number of apps available in leading app stores as of 1st quarter 2021," May 13, 2021, Statista, accessed April 22, 2022, https://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/; Mosk. Decl., Ex. 100, "How Google Play works," Google Play, accessed April 21, 2022, https://play.google.com/about/howplayworks/; Mosk. Decl., Ex. 108.

Amazon developed its own operating-system variant of Android, the "Fire OS," minimized migration costs for developers,[80] and started offering its own short-lived smartphone in 2014.[81]

(2) Direct evidence of market power: Google Play profitability

55. In addition to market share and entry barriers, profit margins can also provide useful insights on market power. I find economic evidence that Google enjoys [redacted].[82]

56. The apps distributed through Google Play generate revenue for Google in four ways: sales of the apps themselves, recurring subscription charges, in-app purchases of digital content, and advertising within the store, [redacted].[83]

57. Google Play has experienced considerable growth over the past decade. [redacted]

[80] Becky Young, "Bring Your Existing Android App to the Amazon Appstore," Appstore Blogs, Amazon Appstore, updated August 8, 2017, https://developer.amazon.com/blogs/appstore/post/b1b5a0d6-c7ae-40fc-8499-7e70e4efa8c9/bring-your-existing-android-app-to-amazon-appstore.

[81] David Pierce, "The Amazon smartphone is here: meet the Fire Phone," The Verge, updated June 18, 2014, https://www.theverge.com/2014/6/18/5819516/meet-the-fire-phone. The Fire phone was unsuccessful, and Amazon stopped selling it a year later. Chris Mills, "Amazon Has Finally Stopped Trying to Sell the Fire Phone," Gizmodo, updated September 8, 2015, https://gizmodo.com/amazon-has-finally-stopped-trying-to-sell-the-fire-phon-1729462204; "Fire Phone," Failory, accessed January 17, 2022, https://www.failory.com/amazon/fire-phone.

[82] Accounting profits are usually higher than economic profits because accounting profits do not account for opportunity costs. The opportunity cost is the forgone benefit when a particular alternative is chosen over another. For example, a firm owning equipment can either engage in production using the equipment or earn the rent by renting out the equipment on the capital market. If the firm chooses to use the equipment for production, it would have to give up the rent or, equivalently, pay the opportunity cost of not renting out the equipment. *See* Joseph E. Stiglitz and Carl E. Walsh, *Principles of Microeconomics*, 4th ed. (W.W. Norton & Company, 2005), 166–167. However, these high accounting profits indicate how Google internally views the profitability of its business.

[83] Mosk. Decl., Ex. 93, sheet [redacted] Mosk. Decl., Ex. 42 at -5896.

[redacted].[84] [redacted]

[redacted].[85] [redacted]

[redacted].[86]

58. [redacted],[87] is a strong indication that competitors are unable to discipline Google's substantial market power.[88]

IV. In-App Payment Solutions Are a Separate Product from Google Play

59. Google requires that developers using Google Play also use its Google Play Billing ("GPB") payment solution for in-app sales of digital goods.[89] Google's tying of these two services is not technologically or otherwise necessary. Developers have used Google's app distribution service coupled with payment solutions provided by third parties in the past and continue to demand such services.

[84] Mosk. Decl., Ex. 102, [redacted]; Mosk. Decl., Ex. 103; Mosk. Decl., Ex. 34. [redacted]

[85] Mosk. Decl., Ex. 104; Mosk. Decl., Ex. 103. [redacted]

[86] Mosk. Decl., Ex. 69 at -8418–19.

[87] Mosk. Decl., Ex. 69 at -8418–19.

[88] In a competitive market, no firm can charge a price above the competitive level (usually the marginal cost) and earn a positive profit. Whenever a firm makes a positive profit, the other incumbent firms would increase their outputs and charge a lower price, or in an industry without barriers to entry, new firms would enter the market and underprice it. *See, e.g.,* Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization*, 4th ed. (Boston: Pearson Addison-Wesley, 2005), 56–64.

[89] *See* Mosk. Decl., Ex. 96, Google Play Payments Policy, § 2–3, https://support.google.com/googleplay/android-developer/answer/9858738. In addition, the policy allows an alternative billing system in South Korea—a policy change mandated by recent South Korean legislation. *See* Mosk. Decl., Ex. 99, Google Play Payments Policy, § 8; Mosk. Decl., Ex. 99, "Understanding Google Play's Payments policy," Play Console Help, https://support.google.com/googleplay/android-developer/answer/10281818?hl=en.

A. Definition of "payment solution"

60. A "payment solution" is a system through which a consumer can submit credentials and receive authorization to make a purchase.[90] Merchants may construct these systems themselves or use a third-party integrated solution. Key components of payment solutions include the forms of payment ("FOPs") accepted by the merchant, payment processors, and payment gateways.[91] Digital transactions involving credit and debit cards, the most common FOPs in e-commerce,[92] require that merchants use a payment gateway, which links the consumer to the merchant's chosen payment processor.[93]

61. Payment solutions available to mobile app developers include (i) a payment solution offered by the app distributor (e.g., Google's GPB and Apple's proprietary payment solution called "IAP"), (ii) a payment solution offered by a third-party provider (e.g., PayPal, Stripe, or Square), or (iii) an in-house payment solution, created by the developer for use within its own apps.[94]

B. Non-digital transactions on Google Play

62. For sales of physical goods made within their apps, Google's policy allows developers to use their own or a non-Google third-party payment solution. In fact, Google requires that GPB *not* be used when payments are (i) primarily for the purchase or rental of physical goods (which Google considers to include Uber and purchases of physical goods made through the Amazon app[95]), (ii) purchase of services or remittance in respect of credit cards or utility bills, (iii) for peer-to-peer payments, online auctions and tax exempt donations, (iv) for content or services that facilitate online

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[90] Jillian Hufford, "A Guide to Payment Solutions for eCommerce Sellers," nChannel, updated October 12, 2016, https://www.nchannel.com/blog/guide-payment-solutions/.

[91] Jillian Hufford, "A Guide to Payment Solutions for eCommerce Sellers," nChannel, updated October 12, 2016, https://www.nchannel.com/blog/guide-payment-solutions/. Common FOPs include cash, debit cards, credit cards, digital wallets, and gift cards.

[92] Credit and debit cards were used in transactions that accounted for 41 percent of total worldwide e-commerce sales in 2018. GlobalData, "Cards dominate e-commerce payments in West while alternative payments rule in Asia, says GlobalData," news release, February 5, 2019, https://www.globaldata.com/cards-dominate-e-commerce-payments-in-west-while-alternative-payments-rule-in-asia-says-globaldata/.

[93] *See, e.g.,* Jason Fernando, "Payment Gateway," Investopedia, updated November 30, 2021, https://www.investopedia.com/terms/p/payment-gateway.asp.

[94] For example, Epic's Direct Payment Solution. The Fortnite Team, "Announcing Epic Direct Payment on Mobile," Epic Games, August 13, 2020, https://www.epicgames.com/fortnite/en-US/news/announcing-epic-direct-payment-on-mobile.

[95] Not to be confused with the Amazon Appstore available on Android devices.

gambling, or (v) in a product category deemed unacceptable under Google's Payments Center Content Policies.[96]

63. Developers selling physical goods can therefore choose to distribute apps through Google Play but use a non-Google payment solution. These facts alone are sufficient to show that demand for separate app distribution and in-app payment solutions products for Android smartphones exist.

C. Digital transactions on Google Play and Google's GPB requirement

64. For sales of digital goods, developers that wish to distribute apps on Google Play must use GPB. Developers must accept Google's Developer Distribution Agreement ("Google Play DDA") to distribute apps on Google Play.[97] The Google Play DDA requires developers to "have a valid Payment Account under a separate agreement with a Payment Processor, be approved by a Payment Processor for a Payment Account, and maintain that account in good standing."[98] The Google Play DDA restricts payment processors to those "authorized by Google to provide services that enable Developers with Payment Accounts to be paid for Products distributed via Google Play."[99]

65. In fact, Google's *only* authorized payment processor for in-app digital products is GPB. The Google Play DDA also requires that developers and their products adhere to Google's "Developer Program Policies,"[100] including a "Payments" policy ("Payments Policy").[101] The Payments Policy specifies that developers must use GPB for (i) paid app downloads from the Play Store and (ii) in-app purchases of digital features and services.[102] In addition, for all transactions for which GPB is required,

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[96] Mosk. Decl., Ex. 96, Google Play Payments Policy.

[97] Mosk. Decl., Ex. 88, "Developer Program Policy," Play Console Help, effective January 17, 2022, https://support.google.com/googleplay/android-developer/answer/11365487?hl=en. ("Repeated or serious violations...[of] the Developer Distribution Agreement (DDA) will result in termination of individual or related Google Play Developer accounts.").

[98] Mosk. Decl., Ex. 66, "Google Play Developer Distribution Agreement," Google Play, effective November 17, 2020 [hereinafter, "Google Play DDA"], § 3.2, https://play.google.com/about/developer-distribution-agreement.html.

[99] Mosk. Decl., Ex. 66, Google Play DDA, § 1.

[100] Mosk. Decl., Ex. 66, Google Play DDA, § 4.1.

[101] "Developer Content Policy," Google Play Developer Policy Center, accessed April 21, 2022, https://play.google.com/intl/en-US/about/developer-content-policy/. *See also* Mosk. Decl., Ex. 96, Google Play Payments Policy.

[102] *See* Mosk. Decl., Ex. 96, Google Play Payments Policy, § 2–3.

the Payment Policy's "anti-steering" clause further prohibits developers from directing users to a payment method other than GPB.[103]

D. There is developer demand for alternative in-app payment solutions for Android smartphones

66. Since the inception of Google Play, app developers have used—and continue to use—separate app distribution and in-app payment solutions products for Android smartphones.

67. Before 2011, GPB did not exist, and developers that distributed apps on the Android Market (Google Play's predecessor) used third-party in-app payment solutions.[104] After Google introduced GPB, Google's payments policy included an exemption for developers selling certain categories of digital content, such as songs and videos, from the requirement to use GPB.[105] [redacted].[106]

68. [redacted].[107] [redacted].[108]

69. [redacted].[109]

[103] "This prohibition includes, but is not limited to, leading users to other payment methods via:" 1. "An app's listing in Google Play;" 2. "In-app promotions related to purchasable content;" 3. "In-app webviews, buttons, links, messaging, advertisements or other calls to action; and" 4. "In-app user interface flows, including account creation or sign-up flows, that lead users from an app to a payment method other than Google Play's billing system as part of those flows." Mosk. Decl., Ex. 96, Google Play Payments Policy, § 4.

[104] *See* Mosk. Decl., Ex. 6 at -0094 [redacted]; Mosk. Decl., Ex. 7, Eric Chu, "In-App Billing on Android Market: Ready for Testing," Google Android Developers Blog, updated March 24, 2011, https://android-developers.googleblog.com/2011/03/in-app-billing-on-android-market-ready.html.

[105] *See* Section VII.B below for more details about the exemption. *See also* Mosk. Decl., Ex. 51 at -4314 from August 2019; Mosk. Decl., Ex. 41 at -2879.

[106] Mosk. Decl., Ex. 51 at -4336, 47.

[107] Mosk. Decl., Ex. 24 at -7420.

[108] Mosk. Decl., Ex. 49.

[109] Mosk. Decl., Ex. 51 at -4315, -47.

[redacted].[110] [redacted].[111] [redacted].[112]

70. Google and third-party surveys provide further evidence of developer demand for an alternative to GPB. For example, [redacted].[113] [redacted]

- [redacted].[114]
- [redacted].[115]

71. In sum, when given the opportunity, as was the case when GPB's policies provided for an exemption to opt out of its services for some types of digital goods sales,[116] developers readily chose alternative payment solutions to GPB.

[110] Mosk. Decl., Ex. 51 at -4314. *See also* Mosk. Decl., Ex. 21 at -2453.
[111] Mosk. Decl., Ex. 51 at -4315, -47.
[112] Mosk. Decl., Ex. 51 at -4315, -47.
[113] Mosk. Decl., Ex. 52 at -7494.
[114] Mosk. Decl., Ex. 84.
[115] Mosk. Decl., Ex. 84.
[116] Mosk. Decl., Ex. 51 at -4314.

E. Google's own offerings resisted using GPB

72. Notably, Google's own app—YouTube—took advantage of the exemption to use non-GPB payment solutions over Google's own GPB.[117] Documents indicate that [redacted].[118] [redacted][119] [redacted].[120]

V. In-App Payment Solutions for Android Smartphones Is a Relevant Market

73. In-app payment solutions for Android smartphones is a relevant antitrust product market if a firm (or firms) can profitably exercise market power over in-app payment solutions for Android smartphones without customers substituting away to a sufficient degree to make such an exercise of market power unprofitable. In this section, I discuss the relevant customers against whom market power might be exercised, and the lack of close substitutes those customers have for in-app payment solutions for Android smartphones. I conclude that the market for in-app payment solutions for Android smartphones is a relevant antitrust product market.

A. Developers are the relevant customers

74. Developers, not end users, are the relevant customers for in-app payment solutions for the simple reason that developers make decisions about which in-app payment solution(s) to incorporate into their apps. By the time a user first encounters the app, the choice of payment solution has already been made.[121] While consumers' preferences will influence developers' choice of payment

[117] Mosk. Decl., Ex. 51 at -4314, 19; Deposition of [redacted], 223:20–225:19, January 14, 2022. (noting that [redacted]

[118] Mosk. Decl., Ex. 31 at -1691, -95.

[119] Mosk. Decl., Ex. 87, Deposition of [redacted], 283:22–284:6, January 14, 2022.

[120] Mosk. Decl., Ex. 89, Deposition of [redacted], 228:11–25, January 14, 2022.

[121] This is not to suggest that users have no effect on the choice of Android in-app payment solutions, but rather that users only have indirect influence over that choice. The payment solution that an Android developer uses for in-app purchases may affect users' experience with the app, which may

solution, that choice will also be influenced by developers' own considerations. For example, a variety of features in current-generation payment solutions—such as tools to manage payment data, process refunds, or create purchase incentives and loyalty programs, as well as services such as analytical reports, fraud protection, and dispute resolution—can help developers to improve operational efficiency, manage customer relationships, and mitigate business risks.[122]

75. The choice of payment solution will reflect what is optimal for the developer, taking into consideration both costs and benefits, and hence, developers' preferences, informed by users' preferences, are the proximate drivers of demand for in-app payment solutions for Android smartphones.

B. Out-of-app payment solutions are not a close substitute for in-app payment solutions

76. Out-of-app payment solutions are not close substitutes for in-app payment solutions for most developers in the relevant product market. In this section, I consider two possible avenues of substitution: a browser-based payment solution and a payment solution on a non-mobile device. Both are not close substitutes and are outside the relevant market of interest.

77. Marketing research suggests that consumers prefer payment solutions that minimize the frictions associated with making an in-app purchase. Amazon, one of the pioneering firms in reducing transaction frictions, has demonstrated the importance of this technology for increasing sales on mobile devices.[123]

78. [redacted]

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lead users to prefer one payment solution over another. Thus, it is economically rational for developers to factor users' preferences into their decision concerning which Android in-app payment solution to integrate into their apps, just as it is economically rational for an automobile manufacturer to factor drivers' preferences into vehicle design decisions.

[122] *See, e.g.*, "Square Secure protects your business so you can focus on your next sale," Square, accessed April 21, 2022, https://squareup.com/us/en/payments/secure; "Boost Revenue with a Global Payments Partner," Braintree, accessed April 21, 2022, https://www.braintreepayments.com/.

[123] Studying Amazon's "1-Click" technology, Ron Berman, Professor of Marketing at the University of Pennsylvania, concluded that "because screens are small, the larger the hassle or number of clicks it is to purchase, the lower the purchase propensity on mobile phones." "Why Amazon's '1-Click' Ordering Was a Game Changer," Knowledge@Wharton, updated September 14, 2017, https://knowledge.wharton.upenn.edu/article/amazons-1-click-goes-off-patent/.

[redacted].[124]

[redacted][125]

[redacted]

[redacted]

[redacted]

[redacted][126]

79. With an in-app payment solution, the user's in-app purchase comprises as few as two steps: (i) the user is presented with an offer to purchase a digital good in the app; and (ii) the user accepts the offer.

80. Google's anti-steering provisions, discussed above, prohibit developers from linking to websites selling these in-app digital goods, or even telling users that such websites exist within the app or in an "app's listing on Google Play."[127] Hence, to complete a sale of in-app digital content outside the developer's Android app, the developer must rely on a user's prior knowledge of websites on which to purchase their digital goods, and which, if any, of those alternative options are available.

81. A browser-based payment solution requires that a user navigate away from the app to a website on an internet browser where the user can complete the purchase of the desired in-app content. Even if such alternative options are known, to make a browser-based purchase on the same device as the app, a user who is already currently using an app and identifies a product she wishes to purchase must: (i) navigate outside of the app; (ii) navigate to and open their internet browser, (iii) direct their internet browser to the proper website for making the digital purchase, either by typing the URL, or by

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[124] Mosk. Decl., Ex. 87, Deposition of [redacted], 150:18–23, 156:4–8, 157:1–24, December 20, 2021.

[125] Mosk. Decl., Ex. 87, Deposition of [redacted], 258:12–259:2, January 14, 2022.

[126] Mosk. Decl., Ex. 87, Deposition of [redacted], 259:18–25, January 14, 2022.

[127] Mosk. Decl., Ex. 68.

performing an internet search for the appropriate website; (iv) find and select the digital good(s) the user would like to purchase; (v) sign in to their preexisting account with the developer and/or enter their payment information; (vi) submit their purchase; (vii) navigate out of the browser on their smartphone; and (viii) reopen the app in which the digital purchase can be used.[128] Payment solutions using browsers on other devices would be subject to all of these steps, as well as the additional steps involved in switching devices.

82. These steps create additional frictions that can result in fewer transactions with users, meaning that developers would not substitute away from GPB in response to a SSNIP over competitive prices in the market for in-app payment solutions for Android smartphones in sufficient numbers to render the price increase unprofitable for the hypothetical monopolist.[129]

83. Selling in-app digital goods through another device is also not a close substitute to an in-app payment solution for Android smartphones. As an initial matter, many apps are mobile-only; for these apps, selling in-app digital goods on a non-mobile device (e.g., a console or PC) is not a substitute for an in-app payment solution for Android smartphones.[130] Even if a developer distributes apps that work on both Android and non-mobile devices, a non-mobile payment solution is not feasible

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[128] Note that (i)–(iii) could be accomplished by a link within the app that takes a user to a particular browser page.

[129] Mosk. Decl., Ex. 87, Deposition of [redacted], 259:12–25, January 14, 2022 [redacted]. These frictions may be less burdensome for large, one-time purchases outside of the app, while requiring app users to make many small-value purchases outside of the app is significantly more damaging for the user experience (and app monetization). *See, e.g.*, Google Play Apps & Games Team, "UX tips to optimize in-app purchases in games," Medium, updated May 12, 2021, https://medium.com/googleplaydev/ux-tips-to-optimize-in-app-purchases-in-games-27ff7ab9625a.

[130] For example, the popular application Pokémon Go makes use of a smartphone's unique location and camera features. As a result, Pokémon Go is only available on mobile. "Pokémon Go," Pokémon, accessed April 25, 2022, https://www.pokemon.com/us/app/pokemon-go/. Similarly, Uber is reliant on location services; while it can technically be used on PC, it is designed specifically for smartphones and is difficult to use without one. Brian Kelleher, "Can you use Uber without a Phone? (2022 Update)," Rideshare-Answers.com, updated July 20, 2021, https://rideshare-answers.com/can-you-use-uber-without-a-phone/.

for many use cases, for example, when the user is away from home and those other devices are generally not accessible. Indeed, to the extent that mobility is the deciding factor in the consumer's decision to use the Android app over non-mobile alternatives, it is unreasonable to suggest that a non-mobile device provides a close substitute to any in-app experience, including in-app purchases.

84. Even when the consumer's non-mobile device is immediately at hand, selling in-app digital goods through another device introduces the frictions associated with selling goods through the browser, plus the significant frictions of requiring the user to shift to a second device, log in to the relevant app, locate the good, and then return to the Android smartphone.[131]

85. Because neither browser nor non-mobile device purchases are close substitutes for in-app purchases, substitution from our candidate product market (involving in-app payment solutions for digital goods) towards these solutions would not constrain a hypothetical monopolist of the candidate market from imposing a SSNIP above competitive prices.

VI. Geographic Scope of the Relevant Markets

86. Relevant antitrust markets have both a product and a geographic element. Geographic bounds on a market may be appropriate if "geography limits some customers' willingness or ability to substitute to some products, or some supplier's willingness or ability to serve some customers."[132] Relevant geographic markets may be delineated based on the location of customers or the location of suppliers.[133] In this case, it is appropriate to delineate relevant geographic markets based on customer location because geographic distance from a supplier's location is not an important criterion for either developers or users, given minimal additional costs for developers to distribute globally.[134]

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[131] For the subset of in-app purchases that can theoretically be deferred or stockpiled (such as a game currency), forcing the consumer to plan purchases in this way is itself a friction.

[132] Horizontal Merger Guidelines 2010, § 4.2.

[133] Horizontal Merger Guidelines 2010, § 4.2.1–4.2.2.

[134] *See* Mosk. Decl., Ex. 105, "Google Play," Android for Developers, accessed April 21, 2022, https://developer.android.com/distribute ("With the ability to publish rapidly to over 2 billion active Android devices, *Google Play helps you grow a global audience* for your apps and games and earn revenue.").

87. Competitive conditions are substantially different in China relative to the rest of the world. Importantly, Google's version of Android and Google Play are unavailable within China.[135] Chinese OEMs thus use alternative "forked" versions of Android and distribute apps through channels other than Google Play.[136] A hypothetical monopolist of app distribution on Android smartphones would be able to impose a small but significant non-transitory price increase on developers and users outside of China without those users arbitraging away those price differences by utilizing products sold to Chinese consumers. Thus, an appropriate geographic market is global, excluding China.[137]

88. The market for in-app payment solutions for Android smartphones is also global, excluding China, for similar reasons as above. In addition, the set of prominent payment solutions providers inside China has little overlap with the set outside of China. Three prominent payment solutions providers in China, serving as both payment gateways and payment providers, include Alipay, Tenpay, and UnionPay.[138] Two prominent payment solutions providers in China, Alipay and Tenpay (including WeChat Pay and QQ Wallet), had a combined 90 percent share of mobile payment transactions in 2019.[139] These payment solutions have limited availabilities outside of China.[140]

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[135] *See, e.g.,* "Is Android blocked in China?" Comparitech, accessed April 19, 2022, https://www.comparitech.com/privacy-security-tools/blockedinchina/android/. *See also* Todd Kuhns, "The Top 15 App Stores In China," AppInChina, updated December 2, 2020, https://www.appinchina.co/blog/the-top-15-app-stores-in-china/.

[136] An Android "fork" is a mobile operating system based on the Android Open Source Project (AOSP), which provides basic smartphone functionality, but is not fully compatible with Google's version of Android. *See, e.g.,* Robert Triggs, "What is AOSP? Everything you need to know," Android Authority, updated August 7, 2021, https://www.androidauthority.com/aosp-explained-1093505/ ("The AOSP contains everything developers need to build Android but it doesn't include everything you need for a finished smartphone… AOSP also doesn't come with Google's suite of software applications, such as its Chrome browser, YouTube, and even the Google Play Store. It also doesn't include a number of Google's under the hood technologies and APIs that enable features like mobile payments, voice commands, and cloud storage. These are licensed separately as Google Mobile Services (GMS)."). *See also* Mosk. Decl., Ex. 45 at -8110.

[137] There may be smaller geographies, such as the U.S., that would also be valid geographic markets for analyzing Google's actions.

[138] "The 7 Most Popular Payment Gateways in China," QPS, updated May 9, 2022, https://qpsoftware.net/blog/most-popular-payment-gateways-china.

[139] Daniel Slotta, "Market share of leading third-party mobile payment providers in China in 2019," Statista, updated April, 7, 2020, https://www.statista.com/statistics/323473/china-leading-third-party-mobile-payment-providers/.

[140] WeChat Pay (of Tencent) and Alipay (of Alibaba) are available to non-Chinese tourists in China on a short-term basis and to Chinese tourists outside of China. *See* Panna Kemenes, "What is

Similarly, prominent payment solutions providers outside of China do not have substantial presences within China: out of three major global payment processors PayPal, Stripe, and Square, only PayPal offers service in Mainland China, and PayPal's popularity in China is considered low.[141] Further, providers' attempts to facilitate sales from merchants to Chinese consumers would have to involve one of the prominent Chinese payment providers as payment gateways (as Stripe did with UnionPay in November 2021).[142]

VII. Google's Tie Forecloses Competition in the Market for In-App Payment Solutions for Android Smartphones and Protects Its Monopoly Power in the Market for App Distribution on Android Smartphones

89. As discussed in Section IV.A. above, Google requires developers to use GPB for in-app digital goods purchases. This tie has foreclosed competition in the market for in-app payment solutions for Android smartphones, leading Google to have a dominant share of the market for in-app payment solutions for Android smartphones. I (conservatively) estimate its market share to be at least [redacted].[143] In this section, I discuss the economics of tying, Google's tying policies and how they have changed over time, and the impact on the market for in-app payment solutions for Android smartphones.

A. Google implemented an anticompetitive tie that forecloses competition in in-app payment solutions for Android smartphones

90. Google's requirement that developers use GPB for in-app purchases represents an anticompetitive tie by which Google uses its market power in app distribution on Android smartphones (the tying market) to foreclose competition in in-app payment solutions for Android smartphones (the tied market).

Alipay, and how does it work?," Wise, updated May 27, 2021, https://wise.com/us/blog/what-is-alipay. "Payment methods in China: How China became a mobile-first nation," daxueconsulting, updated July 4, 2021, https://daxueconsulting.com/payment-methods-in-china/.

[141] "China Payment Systems Guide: Alipay vs WeChat Pay vs UnionPay," Mind Studios, updated August 2, 2021, https://themindstudios.com/blog/china-payment-systems-guide/. "Ways to accept payments in China CN," Shopify, accessed April 22, 2022, https://www.shopify.com/payment-gateways/china

[142] Jon Yeow, "Global support for Chinese payment methods," Stripe, updated November 2, 2021, https://stripe.com/blog/global-launch-of-chinese-payment-methods.

[143] See Appendix A for details.

91. Consider two products (or services) A and B. Tying occurs when the seller of product A refuses to sell product A to a consumer unless the consumer also purchases product B. In this scenario, product A is referred to as the "tying product" and product B as the "tied product,"[144] which could be acquired separately but for the tie.[145] Thus, the first requirement of analyzing whether a contractual restriction to condition the sale of one good on the sale of another good constitutes a tie is to analyze whether the two are separate products.[146] As I have shown in Section IV above, app distribution on Android smartphones and in-app payment solutions for Android smartphones are in fact distinct products.

92. It should first be noted that in some instances tying can be benign, but in others it can have anticompetitive motives and effects. For example, tying can induce anticompetitive effects by foreclosing existing competitors or preventing new competitors from entering the tied market. That is, a firm with monopoly power in the tying product market can use a tie to create artificial entry barriers in the tied good market, which forecloses competition in the tied market. In addition to foreclosing competition in the tied market, tying may also bolster the tying firm's market power in the *tying* market by increasing barriers to entry. As I show in this section, Google's policies that create a tie between the two markets by forcing developers to accept the Google Play DDA is an anticompetitive tie that forecloses competition.[147]

B. Google has strengthened the tie over time

93. At several points in time, Google has considered whether to loosen or strengthen its tie, as well as whether to amend its commission rates. In each instance, Google ultimately chose not to loosen the tie or even to strengthen the tie further.

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[144] Dennis W. Carlton and Michael Waldman, "The Strategic Use of Tying to Preserve and Create Market Power in Evolving Industries," *The RAND Journal of Economics* 33, no. 2 (2002): 194–220, doi: 10.2307/3087430.

[145] Daniel Mandrescu, "Tying and bundling by online platforms–Distinguishing between lawful expansion strategies and anti-competitive practices," *Computer Law & Security Review* 40, no. 105499. doi: 10.1016/j.clsr.2020.105499.

[146] The concept of "separate products" can be operationalized by determining whether the products are in distinct antitrust relevant markets.

[147] As discussed in Section 26IV.A above. *See also* Mosk. Decl., Ex. 88, "Developer Program Policy," Play Console Help, effective January 17, 2022, https://support.google.com/googleplay/android-developer/answer/11365487?hl=en.

94. [redacted].[148] [redacted],[149] [redacted].[150] [redacted].

95. More recently, Google announced that it would close the exemptions to its Google Play Payments Policy and thereby expand the tie. Prior to this change, and as discussed in Section IV above, Google permitted certain developers to use non-GPB payment solutions in instances in which the payment is for "digital content that may be consumed outside of the app itself (e.g., songs that can be played on other music players)."[151] In September 2020, Google changed course and announced that it was removing the exemption that some industry observers had termed the "loophole."[152] Although the new policy was to take effect on January 20, 2021, Google has provided existing app developers more time if they were already using an alternative billing system.[153] In its most recent announcement regarding its policy change, Google has stated that "[s]tarting June 1, 2022, any app that is still not compliant will be removed from Google Play."[154] As a result of Google's change of policy, Android developers who had already invested in the creation of their own payment solutions incurred a sunk cost and must now incur additional cost through implementing GPB and having to bear the resulting

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[148] Mosk. Decl., Ex. 35.

[149] Mosk. Decl., Ex. 37 at -5560.

[150] Mosk. Decl., Ex. 37 at -5550.

[151] *See* Mosk. Decl., Ex. 51 at -4314 and Section IV.D above.

[152] Justin Cuplar, "Google officially closes its revenue-share loophole," IT PRO, updated September 30, 2020, https://www.itpro.com/mobile/google-android/357293/google-officially-closes-its-revenue-share-loophole.

[153] Mosk. Decl., Ex. 94, "Updates to Google Play Policies," Play Console Help, accessed April 21, 2022, https://support.google.com/googleplay/android-developer/answer/9934569#zippy=%2Csummary-of-changes%2Coctober%2Cjanuary. On July 16, 2021, Google allowed developers to request a six-month extension to the September 30, 2021 deadline. *See* Mosk. Decl., Ex. 76, Purnima Kochikar, "Allowing developers to apply for more time to comply with Play Payments Policy," Android Developers Blog, updated July 16, 2021, https://android-developers.googleblog.com/2021/07/apply-more-time-play-payments-policy.html.

[154] Mosk. Decl., Ex. 99, "Understanding Google Play's Payments policy," Play Console Help, https://support.google.com/googleplay/android-developer/answer/10281818?hl=en.

commission rates imposed by Google or risk being removed from the store. I understand that this motion is being filed to challenge Google's termination of the exemption to its GPB policy.

96. Subsequent to its changed policy announcement, Google has continued to evaluate allowing [redacted].[155] [redacted].[156] [redacted].[157] Google ultimately was forced by new legislation to introduce billing optionality in Korea (announced in November 2021), but kept its commission in place, reducing it by 4 percent for developers using an alternate billing system.[158] To date, however, [redacted].[159]

C. Impact of the tie on the markets for in-app payment solutions for Android smartphones and app distribution on Android smartphones

97. As a result of the tie, Google has a dominant market share of Android in-app payment solutions of [redacted].[160] I discuss the anticompetitive effects of the tie on the Android in-app payment solutions market in more detail in Section VIII below.

98. The tie also protects Google Play's monopoly power in the market for app distribution on Android smartphones by requiring "two-level" (or "two-stage") entry. That is, if it is costlier or riskier to enter two markets simultaneously than sequentially, a firm can erect entry barriers by tying two markets together, requiring simultaneous entry and preventing the easier path of sequential

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155 Mosk. Decl., Ex. 71 at -9122, 65.
156 Mosk. Decl., Ex. 78 at -0154.
157 Mosk. Decl., Ex. 82 at -9043.
158 Mosk. Decl., Ex. 85, "Enabling alternative billing systems for users in South Korea," Google Developers, updated November 4, 2021, https://developers-kr.googleblog.com/2021/11/enabling-alternative-billing-in-korea-en.html.
159 Mosk. Decl., Ex. 83 at -9537.
160 See Appendix A for details.

entry.[161] [redacted] [162] Absent the tie, the barriers to entry into the market for app distribution on Android smartphones would be significantly lowered (not requiring simultaneous entry), thereby threatening Google's position in that market.

99. [redacted].[163] [redacted].[164] [redacted].[165] [redacted].[166] [redacted].[167] [redacted].[168] [redacted].

[161] U.S. Department of Justice, "Vertical Merger Guidelines," updated June 30, 2020, 7–8, https://www.ftc.gov/system/files/documents/reports/us-department-justice-federal-trade-commission-vertical-merger-guidelines/vertical_merger_guidelines_6-30-20.pdf.

[162] *See* Mosk. Decl., Ex. 71 at -9151–53.

[163] *See* Mosk. Decl., Ex. 71.

[164] Mosk. Decl., Ex. 71.

[165] Mosk. Decl., Ex. 71 at -9097.

[166] Mosk. Decl., Ex. 71 at -9097, 103.

[167] Mosk. Decl., Ex. 71 at -9157, 170–171.

[168] Mosk. Decl., Ex. 71 at -9151–153, 159–160.

100. [redacted].[169] [redacted].[170] [redacted].[171] [redacted].[172] [redacted].[173] [redacted].[174]

VIII. Google's Conduct Leads to Anticompetitive Effects in Both the Markets for App Distribution on Android Smartphones and In-App Payment Solutions for Android Smartphones

A. Higher prices for developers and consumers

101. More competition in app distribution on Android smartphones and in-app payment solutions for Android smartphones would lead to lower prices for developers and users. Absent foreclosure by Google, entrants would compete away some or all of the high and increasing profits that Google earns from Google Play and GPB.[175]

102. Google's supracompetitive commission rates represent a cost to app developers, a certain amount of which is passed on to consumers in the form of higher in-app purchase prices. The extra amount that consumers have to pay compared to the amount of the increased costs for developers is called pass-on (or pass-through).

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169 Mosk. Decl., Ex. 71 at -9160.
170 Mosk. Decl., Ex. 71 at -9151–152.
171 Mosk. Decl., Ex. 71 at -9151–152.
172 Mosk. Decl., Ex. 71 at -9170–171.
173 Mosk. Decl., Ex. 71 at -9170–171.
174 Mosk. Decl., Ex. 71 at -9170–171.
175 *See* Mosk. Decl., Ex. 44 at -5534 [redacted]

103. The extent to which an increase in marginal costs is passed on from app developers to app users (such as one resulting from Google's commissions) depends primarily on the price elasticity of user demand (i.e., how sensitive users are to prices, or how much quantity demanded changes in light of a price change), which itself depends on the availability of competing apps. What developers pay Google is commissions (e.g., a percentage of the price developers charge their apps' users), rather than a simple cost (e.g., a specific dollar amount). Google's supracompetitive commissions result in apps and in-app purchases being priced higher than they would be with competition. For example, the more elastic demand for an app is—and hence the more quantity demanded increases in response to a decline in price—the more price decreases would be profitable for the app developer. Therefore, more of a commission decrease would be passed on to consumers as lower prices compared to a situation when demand is less elastic.[176]

104. In line with economic theory, practice shows that there is pass-through of Google's commission rate to end consumers. When given the opportunity, app developers have passed on savings from lower commissions to their users.[177]

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[176] Peter Davis and Eliana Garcés, *Quantitative Techniques for Competition and Antitrust Analysis*, (Princeton, NJ: Princeton University Press, 2009): 372.

[177] An Indian panel discussion with industry experts on "Regulating App Stores in India," organized by The Alliance of Digital India Foundation (ADIF), noted that "[A]pp developers worked on small margins and these high commission rates can make businesses unviable forcing them to offload these costs onto the users – thus increasing the cost of access to service." For example, "In India, the dating app Truly Madly is priced 30% higher on iOS than on Android because the 30% commission hasn't been enforced on the Google Play Store as yet, highlighting how the high commission is passed onto consumers." "Legislation for in-app purchases is extremely critical for growing the start-up ecosystem in India: Lessons to be learned from South Korea, US, and EU," Coalition for App Fairness, accessed April 14, 2022, https://appfairness.org/legislation-for-in-app-purchases-is-extremely-critical-for-growing-the-start-up-ecosystem-in-india-lessons-to-be-learned-from-south-korea-us-and-eu/. Prices for plans for Bookedin Appointment Scheduler in the App Store and Google Play are higher than the prices on their website in order "to compensate for additional fees Apple and Google charge Bookedin to sell [their] app in their store." "Why are the prices different in App Store/Google Play," Bookedin, accessed April 14, 2022, https://support.bookedin.com/hc/en-us/articles/360028446492-Why-are-the-prices-different-in-App-Store-Google-Play-. Adrian Ong, from Match Group, testified in *Epic v. Apple*, "Q. Would there be benefits to Match Group from being able to transact directly with the end users of your products? A. Yes. Q. What would some of those benefits be? A. Again, we would not pay the margins of the 30 percent to Apple, which in turn would result in lower prices for customers." Deposition of Adrian Ong, 34:19–35:1. Shahar Ziv, "Here's Why Your Apple App Store Purchases May Be A Ripoff," Forbes, updated July 8, 2020, https://www.forbes.com/sites/shaharziv/2020/07/08/heres-why-your-apple-app-store-purchases-may-be-a-ripoff/?sh=45c575ab2007. A European Commission investigation into the 30% in-app purchase

B. Reduced innovation and variety in-app payment solutions for Android smartphones

105. Google's tie from app distribution to in-app payment solutions for Android smartphones forecloses competitors and potential competitors. [redacted].[178] Foreclosed competitors for GPB on Android devices include both existing third-party payment solutions providers that operate similar services on other devices and platforms and potential entrants.

i. Prominent third-party providers capable of offering payment solutions include PayPal, Stripe, and Square, but there also exist many (potentially) lesser-known providers such as Authorize.net or Braintree, or even developers creating their own in-house payment solutions to use on their own apps.

ii. Another group of potential entrants are companies that are neither currently in the market for in-app payment solutions for Android smartphones nor active in related markets (i.e., *de novo* entrants). It is typically not possible to identify specific *de novo* entrants in advance of their entry. It is however reasonable to expect that, with Google's artificial entry barriers removed, some firms would enter in response to the profit opportunities available.[179] That is, given Google's supracompetitive profits, companies certainly have the incentives to enter if afforded the opportunity.

106. Absent the tie, competition in in-app payment solutions for Android smartphones would naturally lead to increased innovation and investment, and a better user experience relative to the status quo.

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commission rate charged by Apple to music-streaming providers found that the fee was "passed on to end users by raising prices, typically from 9.99 to 12.99 Euros." European Commission, "Statement by Executive Vice-President Margrethe Vestager on the Statement of Objections sent to Apple on App Store rules for music streaming providers," news release, Apr. 30, 2021, https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_21_2093.

[178] *See* Mosk. Decl., Ex. 71 at -9159.

[179] *See, e.g.*, Mosk. Decl., Ex. 38 at -9200 [redacted]

107. Research on the economics of innovation shows that firms will invest in costly innovation only if they can expect a positive return on their investment.[180] In a 2017 paper on raising rivals' costs, Steven Salop summarizes how customer foreclosure can reduce incentives to innovate:

> [B]y reducing the competitor's likely potential customer base, customer foreclosure may reduce the rival's incentives to invest and innovate over time. This can harm consumers directly. It also can weaken the monopolist's own incentives to innovate.[181]

108. Evidence in this litigation further shows that payment solutions providers other than Google have introduced a wide variety of innovations that are unavailable to vendors of digital goods apps in Google's ecosystem. For example, GPB does not currently accept Buy Now, Pay Later (BNPL), a form of instant lending that gives shoppers the option to pay over time for the purchased good without requiring a credit card.[182] BNPL's absence from GPB prevents developers of digital goods apps from realizing the increased sales that BNPL can facilitate, which would directly benefit these developers.[183] Similarly, GPB does not support Japan's Konbini vouchers, which account for nearly 10 percent of online purchases in Japan.[184] These vouchers allow customers to purchase goods,

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[180] Austan Goolsbee, Steven Levitt, and Chad Syverson, *Microeconomics*, 2nd ed. (New York: Worth Publishers, 2016), 541–571.

[181] Steven Salop, "The Raising Rivals' Cost Foreclosure Paradigm, Conditional Pricing Practices, and the Flawed Incremental Price-Cost Test," *Antitrust Law Journal* 81, no. 2 (2017): 387–388.

[182] Third-party payment solutions that currently process Android In-App Purchases in a limited capacity offer BNPL services for other digital sales. For example, PayPal offers "Pay in 4," which is "a digital BNPL product, available everywhere online you can pay with PayPal." *See* Ava Crawford, "How does PayPal Pay in 4 work? Here's everything you need to know before signing up," Mozo, updated August 27, 2021, https://mozo.com.au/buy-now-pay-later/articles/how-does-paypal-pay-in-4-work-here-s-everything-you-need-to-know-before-signing-up. The payments industry has noted that BNPL may be a helpful tool for firms that sell digital goods as it may help reduce "cart abandonment." *See also* "Payments Orchestration Helps Digital Goods Companies Make The Instant Sale," PYMNTS.com, updated December 23, 2020, https://www.pymnts.com/news/retail/2020/payments-orchestration-helps-digital-goods-companies-make-the-instant-sale/.

[183] "The Benefits of Customer Financing: Increase AOV 15% with Consumer Credit Options," Verizon, accessed April 22, 2022, https://www.verizon.com/business/small-business-essentials/resources/if-youve-been-to-a-big-box-retailer-lately-youve/.

[184] "Konbini," Adyen, accessed April 22, 2022, https://www.adyen.com/payment-methods/econtext-konbini.

services, or digital products online and pay for them with cash at any one of 40,000 convenience stores.[185]

109. Google's conduct also leads to a lessening in investments in payment solutions. [redacted] [186] Hence, Google's tie reduces the amount of investment in alternatives to its payments solution, which in turn reduces the developers' ability to offer payment solutions tailored to their needs, as well as reducing Google's own incentives to innovate.

110. Without the tie, developers could offer users a better payment experience in a variety of ways:

i. A wider variety of forms of payment for in-app purchases due to competition between payment solution providers.

ii. For apps that sell both physical and digital goods, a uniform checkout flow for both types of purchases.

iii. Better compatibility with decentralized marketplaces where users can set and modify prices freely.

iv. A more direct customer relationship to handle customer support issues

v. Better payment reprocessing options.

vi. Alternative payment solutions could more fully allow for developers to leverage add-ons, apps, and plugins in the payment system that could improve user experience.[187]

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[185] "Local payments in Japan - JCB, Konbini and Pay-Easy," Verifone, accessed April 22, 2022, https://verifone.cloud/docs/2checkout/Documentation/03Billing-and-payments/Payment-methods/Local-payments-in-Japan-JCB-and-Konbini; "A Brief Guide on How to Purchase Games Online with No Credit Card in Japan," Japan Info, updated April 26, 2016, https://jpninfo.com/49089.

[186] *See* Mosk. Decl., Ex. 60 [redacted]

[187] Payment solutions like PayPal and Square can be seamlessly integrated with apps and websites. For example, WordPress, a popular platform for designing and publishing business website, allows merchants to integrate both PayPal and Square with merchant websites developed on their platform. *See* Shayla Price, "Best WordPress PayPal Plugins to Accept Payments," accessed April 22, 2022, https://blog.hubspot.com/website/best-wordpress-paypal-plugins-to-accept-payments. *See also*

C. Reduced innovation in app distribution

111. Based on the same economic logic as described above, Google's restrictive practices, which increase barriers to entry in app distribution (as explained in Section VIII.B) also harm innovation in apps and app distribution services.

112. For example, evidence from industry participants supports the view that Google's high prices discourage innovation and entry by app developers:

- [redacted][188]
- Jared Sine, Chief Legal Officer at Match Group testified for the U.S. Senate Judiciary Committee that Google's and Apple's commissions amounted to "500 million dollars that could be going back into the pockets of everyday consumers or deployed to hire employees or invest in new innovations."[189]
- In 2020, Apple announced that it would lower App Store fees for small app developers to 15%, which would help "small and independent developers continue working to innovate and thrive."[190]

113. Google's restrictive practices have also prevented innovation in app distribution by app stores competing by offering better services, prices, and/or curation. Examples of such (potential) app store competitors include entrance into Android app distribution by:

- [redacted],[191]

"WordPress and Square," Square Support, accessed April 22, 2022, https://squareup.com/help/us/en/article/6512-wordpress-and-square.

[188] [redacted] Mosk. Decl., Ex. 32 at -0706.

[189] Antitrust Applied: Examining Competition in App Stores: Hearing before Senate Subcommittee on Competition Policy, Antitrust, and Consumer Rights, 117th Cong. (2021) (testimony of Jared Sine, Chief Legal Officer, Match Group).

[190] Todd Spangler, "Apple App Store 'Tax Cut' for Small Developers Slammed by Spotify, Epic Games," Variety, updated November 18, 2020, https://variety.com/2020/digital/news/apple-app-store-fee-cut-developers-spotify-epic-1234834668/.

[191] As highlighted in an internal 2014 Google document. Mosk. Decl., Ex. 13 at -0006–08.

- [redacted],[192] and
- [redacted].[193]

[192] For example, [redacted]. Mosk. Decl., Ex. 106; Mosk. Decl., Ex. 30 at -4840.

[193] For example, [redacted]. Mosk. Decl., Ex. 4 at -9907 [redacted]; Mosk. Decl., Ex. 13 at -0012.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct and that I executed this declaration on April 28, 2022, in Berkeley, California.

Steven Tadelis

Appendix A. Calculation of GPB market share

114. This section presents the underlying calculations for my estimation of GPB's share in the market for in-app payment solutions for Android smartphones, using conservative estimates.

115. Data and documents produced in this matter indicate show that Google's [redacted], [redacted][194], [redacted][195] and Samsung Galaxy Store's [redacted][196] I assume that the stores maintained by the OEMs Oppo, Xiaomi, and Vivo[197] each generated the same amount of revenue as Samsung's [redacted].[198] Finally, I incorporate the issue of developers' potential non-compliance with GPB's billing policies in the context of subscription services, assuming that revenues generated in non-compliance were equal to Google Play's entire subscription revenues [redacted].[199]

116. Taking these conservative assumptions together gives an estimated total market size of [redacted].[200] The lower-bound estimate of Google's market share in the market for Android in-app payment solutions [redacted] (equal to [redacted]).

117. I repeat the above-described steps for both [redacted], using matching assumptions. I estimate that Google's market share was [redacted][201] and [redacted].[202]

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[194] Mosk. Decl., Ex. 93.

[195] Mosk. Decl., Ex. 109.

[196] Mosk. Decl., Ex. 39 at -2836.

[197] Oppo, Xiaomi, and Vivo [redacted] Mosk. Decl., Ex. 53; Mosk. Decl., Ex. 92.

[198] This approach considers the upper bound of Samsung's app store and conservatively assumes that the revenue of these minor stores is entirely derived from in-app purchases.

[199] Mosk. Decl., Ex. 93.

[200] [redacted]

[201] The corresponding [redacted] revenues were [redacted] for Google (Mosk. Decl., Ex. 93) and [redacted] (Mosk. Decl., Ex. 109). I assume [redacted] revenues for Samsung, Oppo, Xiaomi, and Vivo were the same as used [redacted]. Google Play's [redacted]

[202] The corresponding [redacted] revenues were [redacted] for Google (Mosk. Decl., Ex. 93) and [redacted] (Mosk. Decl., Ex. 109). I assume Samsung's [redacted] revenue growth from [redacted] was equal to that of Google Play, therefore estimating Samsung's [redacted] revenue to be [redacted], and assume this same amount for Oppo, Xiaomi, and Vivo. Google Play's [redacted].

Appendix B. Materials relied upon

A. Discovery

- AB-GOOG-000492
- AMZ-GP_00001497
- AMZ-GP_00001836
- Deposition of [redacted], December 20, 2021; January 14, 2022.
- Deposition of [redacted], February 2, 2022.
- Deposition of [redacted], February 10, 2022.
- Deposition of [redacted], January 14, 2022.
- GOOG-PLAY-000092281
- GOOG-PLAY-000096813
- GOOG-PLAY-000237798
- GOOG-PLAY-000257419
- GOOG-PLAY-000292636
- GOOG-PLAY-000304837
- GOOG-PLAY-000320285
- GOOG-PLAY-000347493
- GOOG-PLAY-000446489
- GOOG-PLAY-000542113
- GOOG-PLAY-000558461
- GOOG-PLAY-000560166
- GOOG-PLAY-001496795
- GOOG-PLAY-001558912
- GOOG-PLAY-002274491
- GOOG-PLAY-002440706
- GOOG-PLAY-004105853
- GOOG-PLAY-004260663
- GOOG-PLAY-004320094
- GOOG-PLAY-004489655
- GOOG-PLAY-004702879
- GOOG-PLAY-004705533
- GOOG-PLAY-004785946
- GOOG-PLAY-004794198
- GOOG-PLAY-007264058
- GOOG-PLAY-007335854
- GOOG-PLAY-007819042
- GOOG-PLAY-007879536
- GOOG-PLAY-008698390
- GOOG-PLAY-010801680
- GOOG-PLAY-010801682
- GOOG-PLAY-010801683
- GOOG-PLAY-010801685
- PX 136 (GOOG-PLAY-003332817.R)
- PX 162 (GOOG-PLAY-000929031)
- PX 166 (GOOG-PLAY-001886111.R)
- PX 167 (GOOG-PLAY-002076224.R)

- PX 290 (GOOG-PLAY-000880576)
- PX 315 (GOOG-PLAY-000051671)
- PX 388 (GOOG-PLAY-006829073)
- PX 388 (GOOG-PLAY-006829073)
- PX 428 (GOOG-PLAY-000416245)
- PX 430 (GOOG-PLAY-001090227)
- PX 439 (GOOG-PLAY-000445893)
- PX 519 (GOOG-PLAY-003334312)
- PX 522 (GOOG-PLAY-000565541.R)
- PX 542 (GOOG-PLAY-007880154)
- PX 591 (GOOG-PLAY-004509200)
- PX 624 (GOOG-PLAY-004488106)
- PX 682 (GOOG-PLAY-000307941.R)
- PX 705 (GOOG-PLAY-000442440)
- PX 708 (GOOG-PLAY-004506631)
- PX 804 (GOOG-PLAY-000439987)
- PX 872 (GOOG-PLAY4-000339905)

B. Public

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https://developer.amazon.com/blogs/appstore/post/b1b5a0d6-c7ae-40fc-8499-7e70e4efa8c9/bring-your-existing-android-app-to-amazon-appstore.

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APPENDIX C: STEVEN TADELIS CURRICULUM VITAE

Steven Tadelis – c.v.

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Berkeley, CA 94720

.
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Homepage: `http://faculty.haas.berkeley.edu/stadelis/`

Employment

07/2015–present	Professor of Economics, Business and Public Policy, UC Berkeley, Haas School of Business, CA
03/2019–present	Sarin Chair in Strategy and Leadership
08/2017–present	Amazon Economist Fellow
07/2016–03/2019	James J. and Marianne B. Lowrey Chair in Business, UC Berkeley
07/2016–08/2017	VP, Economics and Market Design, Amazon Inc., Seattle, WA
07/2015–6/2016	Joe Shoong Chair in International Business, UC Berkeley
07/2005–06/2015	Associate Professor of Business and Public Policy, UC Berkeley, Haas School of Business, CA
08/2011–08/2013	Sr. Director, Distinguished Economist, eBay Research Labs, San Jose, CA
09/2012–12/2012	Visiting Professor of Economics, Columbia University GSB, New York, NY
01/2010–03/2010	Visiting Professor of Economics, MIT Sloan School, Cambridge, MA
11/2006–1/2009	Associate Dean for Strategic Planning, UC Berkeley, Haas School of Business, CA
09/2003	Visiting Assistant Professor of Economics, Arizona State University, Tempe, AZ
07/1997–06/2005	Assistant Professor of Economics, Stanford University, Stanford, CA

Education

Harvard University, Cambridge, MA USA: M.A. Economics, 1994; Ph.D. Economics, 1997.

Technion, Haifa, Israel: M.Sc. Economics (with Special Honors), 1992

University of Haifa, Haifa, Israel: B.A. in Economics (with Special Honors), 1991

Professional Affiliations

Research Network Fellow, Center for Economic Studies, ifo Institute (CESifo) 2017–present

Research Fellow, Centre for Economic Policy Research (CEPR), 2015–present

Research Associate, National Bureau of Economic Research (NBER), 2014–present

Publications

Journal Articles

1. "Raising the Bar: Certification Thresholds and Market Outcomes," with Xiang Hui, Maryam Saeedi and Giancarlo Spagnolo.
American Economic Journal: Microeconomics. Forthcoming.

2. "Expectation, Disappointment, and Exit: Reference-Point Formation in a Marketplace," with Matthew Backus, Tom Blake and Dmitriy Masterov.
Journal of the European Economic Association. Forthcoming.

3. "Price Salience and Product Choice," with Tom Blake, Sarah Moshary and Kane Sweeney.
Marketing Science. 40(4):619-636 (2021)

4. "People Management Skills, Employee Attrition, and Manager Rewards: An Empirical Analysis," with Mitchell Hoffman.
The Journal of Political Economy. 129(1):243-285 (2021)

5. "Buying Reputation as a Signal of Quality: Evidence from an Online Marketplace," with Lingfang (Ivy) Li and Xiaolan Zhou.
Rand Journal of Economics. 51(4):965-988 (2020)

6. "How Individuals Respond to a Liquidity Shock: Evidence from the 2013 Government Shutdown," with Michael Gelman, Shachar Kariv, Matthew D. Shapiro and Dan Silverman.
The Journal of Public Economics. 189 (2020) 103917

7. "Sequential Bargaining in the Field: Evidence from Millions of Online Bargaining Interactions," with Matthew Backus, Tom Blake and Brad Larsen.
The Quarterly Journal of Economics. 135(3):1319–1361 (2020)

8. "On the Empirical Content of Cheap-Talk Signaling: An Application to Bargaining," with Matthew Backus and Tom Blake.
The Journal of Political Economy. 127(4):1599-1628 (2019)

9. "Reputation and Feedback Systems in Online Platform Markets,"
Annual Review of Economics, 8(1):321-340 (2016)

10. "Returns to Consumer Search: Evidence from eBay," with Tom Blake and Chris Nosko.
17th ACM Conference on Electronic Commerce, (EC 2016) pp.531-545 (2016)

11. "The Economics of Reputation and Feedback Systems in eCommerce Marketplaces,"
IEEE Internet Computing, 20(1):12-19 (2016)

12. "Canary in the e-Commerce Coal Mine: Detecting and Predicting Poor Experiences Using Buyer-to-Seller Messages," with Dmitriy Masterov and Uwe Mayer
16th ACM Conference on Electronic Commerce, (EC 2015) pp.12-19 (2015)

13. "Is Sniping A Problem For Online Auction Markets?," with Matthew Backus, Tom Blake and Dmitriy Masterov
Proceedings of the 24th ACM International World Wide Web Conference, (WWW24) pp.12-19 (2015)

14. "Information Disclosure as a Matching Mechanism: Theory and Evidence from a Field Experiment," with Florian Zettelmeyer
American Economic Review, 105(2):886-905 (2015)

15. "Consumer Heterogeneity and Paid Search Effectiveness: A Large Scale Field Experiment," with Chris Nosko and Tom Blake
Econometrica, 83(1):155-174 (2015)
Finalist: 2016 ISMS/MSI Gary Lilien Marketing Science Practice Prize

16. "Harnessing Naturally-Occurring Data to Measure the Response of Spending to Income," with Michael Gelman, Shachar Kariv, Matthew D. Shapiro and Dan Silverman
Science, 345(6193):212-215 (2014)

17. "Bidding for Incomplete Contracts: An Empirical Analysis," with Pat Bajari and Stephanie Houghton
American Economic Review, 104(4):1288-1319 (2014)

18. "Public Procurement Design: Lessons from the Private Sector,"
International Journal of Industrial Organization, 30(3):297-302 (2012)

19. "A Theory of Moral Persistence: Crypto-Morality and Political Legitimacy," with Avner Greif
Journal of Comparative Economics, 38(3):229-244 (2010)
Recipient: Montias prize - best article published in JCE in 2010-2011

20. "Contracting for Government Services: Theory and Evidence from U.S. Cities," with Jonathan Levin
Journal of Industrial Economics, 58(3):507-541 (2010)

21. "Auctions versus Negotiations in Procurement: An Empirical Analysis," with Pat Bajari and Rob McMillan
Journal of Law, Economics and Organization, 25(2):372-399 (2009)

22. "Seller Reputation," with Heski Bar-Isaac
Foundations and Trends in Microeconomics, 4(4):273-351(2008)

23. "The Innovative Organization: Creating Value through Outsourcing,"
California Management Review, 50(1):261-277 (2007)

24. "Profit Sharing and the Role of Professional Partnerships," with Jonathan Levin
Quarterly Journal of Economics, 120(1):131-172 (2005)

25. "Firm Reputations with Hidden Information,"
Economic Theory. 18(2):537-553 (2003)

26. "The Market for Reputations as an Incentive Mechanism,"
The Journal of Political Economy. 110(4):854-882 (2002)

27. "Complexity, Flexibility and the Make or Buy Decision,"
*American Economic ReviewPapers and Proceedings.*92(2):433-437 (2002)

28. "Incentives versus Transactions Costs: A Theory of Procurement Contracts," with Pat Bajari
Rand Journal of Economics, 32(3):387-407 (2001)

29. "What's in Name? Reputation as a Tradeable Asset,"
American Economic Review. 89(3):548-563 (1999)

30. "Pareto Optimality and Optimistic Stability in Repeated Extensive Form Games,"
Journal of Economic Theory. 69(2):270-299 (1996)

Book Chapters and Invited Papers

31. "How Artificial Intelligence and Machine Learning Can Impact Market Design," with Paul R. Milgrom
in A. Agarwal, J. Gans and A. Goldfarb (Eds.) *The Economics of Artificial Intelligence: An Agenda.* University of Chicago Press. (2019)

32. "Two-Sided eCommerce Marketplaces and the Future of Retailing,"
in E. Baskar (Ed.) *Handbook on the Economics of Retail and Distribution.* Edward Elgar Publishing. (2016)

33. "Property Rights and Transaction Costs Theories,"
in Aghion, P., M. Dewatripont, P. Legros and L. Zingales (Eds.) *The Impact of Incomplete Contracts on Economics.* Oxford University Press. (2016)

34. "Transaction Cost Economics," with Oliver E. Williamson
in R. Gibbons and J. Roberts (Eds.) *Handbook of Organizational Economics.* Princeton University Press. (2012)

35. "Jonathan Levin: 2011 John Bates Clark Medalist," with Liran Einav
Journal of Economics Perspectives, 26(2), 207-222 (2012)

36. "A Tribute to Oliver Williamson: Williamson?s Contribution and Its Relevance to 21st Century Capitalism,"
California Management Review, 52(2):159-166 (2010)

37. "Incentives and Transaction Costs in Public Procurement,"
in C. Menard and M. Ghertman (Eds.) *Regulation, Deregulation & Reregulation.* Edward Elgar Publishing. (2009)

38. "Incentives and award procedures: competitive tendering vs. negotiations in procurement," with Patrick Bajari
in N. Dimitri, G. Piga and G. Spagnolo (Eds.) *Handbook of Procurement.*

Working Papers and Papers Under Review

39. "Communication and Bargaining Breakdown: An Empirical Analysis" with with Matthew Backus and Tom Blake. January 2018

40. "The Economics of Algorithmic Pricing: Is collusion really inevitable?" with Kai-Uwe Kuhn. January 2018

41. "The Response of Consumer Spending to Changes in Gasoline Prices," with Michael Gelman, Yuriy Gorodnichenko, Shachar Kariv, Dmitri Koustas, Matthew D. Shapiro and Dan Silverman. December 2016. NBER working paper no. w22969.

42. "The Limits of Reputation in Platform Markets: An Empirical Analysis and Field Experiment," with Chris Nosko. February 2015

43. "The Power of Shame and the Rationality of Trust," March 2011

44. "A Costly Contracting Approach to the Organization of Production," with Jonathan Levin. December 2006

45. "Apprenticeships: Human Capital and Competitive Signaling in a Dynamic Labor market," with Antonio Rangel. December 2001

46. "Renegotiation in Agency Contracts: The Value of Information," with Ilya Segal. December 1996

Books

1. *Game Theory: An Introduction.* Princeton University Press, 2012.

2. *Solutions to Exercises: Microeconomic Theory, by A. Mas-Colell, M. Whinston and J.Green.* (with Chiaki Hara and Ilya Segal) Oxford University Press, 1996.

Grants

NSF grant: "Bilateral Bargaining through the Lens of Big Data," (Matt Backus, Brad Larsen and Matt Taddy, co-PIs), 2016-2018 (SES-1629060).

Sloan Foundation grant "Harnessing Naturally-Occurring Data to Study Financial Change of Older Americans," (Mathew D. Shapiro, PI; Daniel Silverman, Shachar Kariv, Steve Tadelis, co-PIs), 2014-2016

Sloan Foundation grant "Database Development Project," (Mathew D. Shapiro, PI; Daniel Silverman, Shachar Kariv, Steve Tadelis, co-PIs), 2012-2014

Yahoo! Faculty Research grant "'Shame and Reputation in Online Transactions," 2008

Research Bridging Grant, UC Berkeley "Identifying the Incentive Effects of Shame," 2007-2009

NSF CAREER grant: "The Organization and Reputation of Firms," 2003-2009 (SES-0239844).

NSF grant: "Market Monitoring and Organizational Form," 2002-2003 (SES-0214555).

NSF grant: "Reputation, Incentives, and Transaction Costs in Firms," 2000-2002 (SES-0079876).

NSF grant: "Reputation with Hidden Information," 1999-2000 (SBR-9818981).

Honors, Awards, & Fellowships

Honorable Mention, Cheit Teaching Award, Full-Time MBA Program, 2010-2011

Montias prize - best article published in the Journal of Comparative Economics in 2010-2011

Barbara and Gerson Bakar Faculty Fellow, UC Berkeley Haas School of Business, 2008-2015

Honorable Mention, Cheit Teaching Award, Full-Time MBA Program, 2006-2007

Phi Beta Kappa Undergraduate Teaching Award, Stanford 2005.

Economics Department Advising Award, Stanford 2002.

National Fellow, Hoover Institution, 1999-2000.

Review of Economic Studies European Tour Speaker, May 1997

Alfred P. Sloan Doctoral Dissertation Fellowship, 1995-1996

Graduate Society Fellowship Term Time Award, Harvard University 1995-1996

Graduate Fellowship, Harvard University 1992-1994

Graduate Fellowship, Technion Graduate School 1991-1992

Merit Scholarship, University of Haifa 1988-1991

Ph.D. Advising

Principal or co-Principal Advisor (first placement in parenthesis):

1. Nhat Le (2000); (Australian National University)
2. Ravi Singh (2003); (Harvard Business School)
3. Ales (Bobby) Filipi (2003); (Bates-White Consulting)
4. Navin Kartik (2004); (UC San Diego)

5. Peter Lorentzen (2007) (UC Berkeley)
6. Ian Larkin (2007) (Harvard Business School)
7. Marina Halac (2009) (Columbia Business School)
8. Rob Seamans (2009) (NYU Stern School of Business)
9. Constanca Esteves-Sorensen (2009) (Yale School of Management)
10. Victor Bennett (2010) (USC Marshall School of Business)
11. Sanny Liao (2010) (Private industry)
12. Vito Sciaraffia (2011) (UT Austin McComb Business School)
13. Amy Nguyen-Chyung (2013) (University of Michigan)
14. Orie Shelef (2013) (Stanford Institute for Economic Policy Research Post Doc)
15. Tarek Ghani (2015) (Washington University, St. Louis)
16. Yujin Kim (2016) (Shanghai University of Science and Technology)
17. Moshe Barach (2016) (Georgetown University)
18. Hyo Kang (2019) (University of Southern California)
19. Oren Reshef (2020) (Washington University, St. Louis)
20. Xin Chen (2020) (Singapore Management University)
21. Andres Gonzales (2021) (Yale postdoc and PUC)

Committee member (first placement in parenthesis):

1. Pablo Ruis-Verdu (2001); (U. Carlos III Spain)
2. Brent Goldfarb (2001); (U. of Maryland)
3. Hongbin Li (2001); (Chinese University of Hong Kong)
4. Luis Rayo (2002); (University of Chicago GSB)
5. David Miller (2004); (UC San Diego)
6. Brian Chen (2009) (Post-Doc at Stanford Law School)
7. Deepak Hegde (2010) (NYU Stern School of Business)
8. Asaf Plan (2010) (Post-Doc at University of Michigan)
9. Dylan Minor (2011) (Northwestern, Kellogg School of Management)
10. Maciej Kotowski (2011) (Harvard Kennedy School)
11. Mitchell Hoffman (2012) (University of Toronto)
12. Valentina Paredes (2013) (University of Chile)
13. Daniel Gross (2015) (Harvard Business School)
14. Christopher Whaley (2016) (RAND corporation)
15. Jordan Ou (2017) (Analysis Group)
16. Hsin-Tien Tiffany Tsai (2020) (National University of Singapore)

Professional Activities

Referee for: *American Economic Review, Quarterly Journal of Economics, Journal of Political Economy, Econometrica, American Economic Journal: Applied Economics, Rand Journal of Economics, Review of Economic Studies, Games and Economic Behavior, International Economic Review, International Journal of Industrial Organization, Journal of Economic Theory, Economic Theory, Economics Letters, Journal of Law and Economics, Journal of Law Economics and Organization, Journal of Economics and Management Strategy.*

Editor/co-Editor

Journal of Law, Economics and Organization, 2011-2014

Editorial Boards/Associate Editor

American Economic Journal: Microeconomics, 2019-present

California Management Review, 2006-2016

American Economic Review, 2005-2008

International Journal of Industrial Organization, 2005-2008

Steering/Scientific/Program Committee Member

The 20th ACM Conference on Economics and Computation (EC'18), Phoenix, June 2019

The 18th ACM Conference on Economics and Computation (EC'16), MIT, June 2017

The 17th ACM Conference on Economics and Computation (EC'16), Maastricht, July 2016

The 24th International World Wide Web Conference (WWW 2015), Florence, May 2015

The 15th ACM Conference on Economics and Computation (EC'14), Stanford, June 2014

"Public Procurement and Sustainable Growth," conference, Venice, October 20-21, 2011

EARIE 2011, Stockholm, Sweden, Sept 1-3, 2011

"First Interdisciplinary Symposium on Reputation Mechanisms in Online Communities", MIT, April 2003

Conference co-organizer

"European Summer Symposium in Economic Theory," (ESSET), Gersenzee, Switzerland, summer 2015

"Private and Public Sector Contracting," SITE, Stanford, summer 2004

"Incentives in Markets and Organizations," SITE, Stanford, summer 2003

"The Theory of Contracts," SITE, Stanford, summer 2000

"Contracts and Organizations," SITE, Stanford, summer 1999

"Contractual Incompleteness," SITE, Stanford, 1998

University Service

Member, Committee on Research, UC Berkeley, July 2015 - July 2016

Ph.D. Program Advisor, Business and Public Policy, Haas School of Business, July 2014 - July 2016

Invited Presentations

Keynote Speaker

CESifo Area Conference on the Economics of Digitization, Munich, Germany November 30 - December 1, 2018

International Workshop on Competition, Regulation and Procurement, National Research University Higher School of Economics, Moscow, Russia, May 28-29, 2018

Conference on Auctions, competition, regulation, and public policy, Lancaster University, U.K., May 24-25, 2018

Online Platform Competition Conference, University of Florida, Florida, March 23, 2018

Industrial Organization, Regulation And Competition Policy In Israel, Hebrew University, Jerusalem, Israel December 28, 2017

Microsoft Research Digital Economics Conference 2017, Redmond, WA, October 20-21, 2017

15th ZEW Conference on The Economics of Information and Communication Technologies, Mannheim, Germany, June 23-24, 2017

INFORMS Conference on Information Systems and Technology, Nashville, TN, November 12-13, 2016

43rd EARIE Annual Conference, Lisbon, Portugal, August 26-28, 2016

International Conference on Game Theory and Multilateral Economic Cooperation, Xi'an, China, June 17-19, 2016

"4th Annual Lithuanian Conference on Economic Research," August 17-18, 2015, , Lithuania

"Eighth bi-annual Postal Economics conference: E-commerce, Digital Economy and Delivery services," April 3-4, 2014, Toulouse, France

"Public procurement and sustainable growth," conference, October 20-21, 2011, Venice, Italy

European School for New Institutional Economics, May 19-23, 2008, Corsica, France

"Public Private Partnerships," conference, December 7-8, 2007, The Sorbone, Paris, France

"Public services and Management: designs, issues and implications for local governance," conference, January 12-14th, 2006, Toulouse, France

Recent Invited Conferences and Seminar Presentations

2019-2020 (including scheduled): EARIE-Barcelona (08/19); Harvard-HBS (10/19); U.Toronto-Rotman (11/19); Northwestern-Kellogg (12/19); Hebrew U. - Jerusalem (12/19);

2018-2019: Melbourne Business Analytics Conference, Melbourne, Australia (07/18); Technology Policy Institute Aspen Forum, Aspen (08/18); FTC Hearing #3: Competition and Consumer Protection in the 21st Century, Arlington, VA (10/18); Monash U., Melbourne (04/19); Melbourne U., Melbourne (04/19); Canterbury U., Christchurch (04/19); UTS, Sydney (04/19); UNSW, Sydney (04/19); Boconni U., Milan (05/19); Collegio Alberto, Turin (05/19); HKUST IO workshop, Hong Kong (06/19); SUFE IO 2019 conference, Shanghai (06/19); ESSET Conference, Gersenzee, Switzerland (7/19)

2017-2018: Annual Reputation Symposium 2017, Oxford University, UK (08/17); NBER Economics of Artificial Intelligence Conference, Toronto (09/17); Carols III University, Madrid, Spain (10/17); CEMFI, Madrid, Spain (10/17); University of Melbourne Business School, Australia (11/17); MSI Conference, SF (02/18); Columbia University IO Seminar, NY (03/18); IJIO Conference, Indianapolis, (04/18); University of Indiana, Bloomington (04/18); Platform Economics Conference, Enaudi, Rome (04/18);

ReStud Reunion Conference, Copenhagen (05/18); Third BCCP Conference and Policy Forum, Berlin, Germany (06/18); 2018 CPMD Workshop on Market Design, Sydney, AUstralia (06/18); BEET 2018 Conference, Columbia University (06/18);

2016-2017: UChicago Law School (11/16); Workshop on Data Ownership, Access and Trade, EU Commission, Brussels (03/17); Columbia University Law School (04/16); Santa Clara University (05/17); Technion, Israel (06/17); Theory of the Firm Conference, Oxford University, UK (06/17); CRESSE Conference, Crete (06/17);

2015-2016: 4th Annual Lithuanian Conference on Economic Research, Vilnius (8/15); GSV Pioneer Summit, Redwood City (10/15); NYU - Stern (10/15); ASU Economics (11/15); DataLead Conference, Paris (11/15); CRAi Brussels Conference (12/15); American Economic Association (1/16); Melbourne University (2/16); eBay ML and Data Analytics Conference (3/16); Ohio State U. Economics (3/16); 2nd Berkeley-Paris Organizational Economics Workshop, Paris (4/16); Digital Initiative Discussion & Symposium, HBS (5/16); Berkeley-Bergen IO Conference, Bergen, Norway (5/16); Universidad de Piura, Lima, Peru (6/16); International conference on game theory and multilateral economic cooperation, Xi'an University, China (6/16);

2014-2015: U. of Colorado Economics (10/14); HKUST Economics (10/14); Yale SOM (10/14); U. of Kansas Economics (11/14); U. Penn Economics (11/14); Harvard Business School (11/14); Tufts U. Economics (12/14); American Economic Association (1/15); Utah Winter Busi- ness Economics Conference (2/15); MIT Sloan (3/15); U. of Toronto Rotman (4/15); Microsoft Research (4/15); WWW, Florence (5/15); EC?15, Portland 6/15); CCP conference, University of East Anglia, UK (6/15); 5th Annual International Conference on Industrial Economics, Zhejiang University, Hangzhou, China (6/15); ESSET Conference, Gersenzee, Switzerland (7/15); NBER Summer Institute (7/15);

Teaching

UC Berkeley

Managerial Economics (Executive MBA program)

Economic Analysis for Business Decisions (1st year MBA core microeconomics)

Incentives in Organizations (PhD class in the business school)

The Economics of Institutions (PhD class in the business school)

Contract Theory (2nd year PhD class in the economics department)

Economic Analysis for Business Decisions (12-28 hour Executive Education module)

Strategic Sourcing (3 hour Executive Education module)

Strategic Pricing (3 hour Executive Education module)

Stanford University

Contract Theory (2nd year PhD class)

Microeconomic Theory (1st year PhD class)

Game Theory and Economic Applications (Undergraduate class)

Intermediate Microeconomics (Undergraduate class)

Columbia University GSB - Visting Professor

Microeconomics, Fall 2012 (MBA Core class)

MIT Sloan School of Management - Visiting Professor

Strategic Thinking, Spring 2010 (MBA elective class)

Arizona State University - Visiting Assistant Professor

Contract Theory, Fall 2003 (2nd year PhD class)

Corporate Experience

Amazon, Seattle, WA, Amazon Scholar (2017-2021)

Guide and support economic analysis for business decisions across the company

Amazon, Seattle, WA, VP Economics and Market Design (2016-2017)

Lead and support economic analysis for business decisions across the company

Help recruit and build teams of economists

eBay Inc, San Jose, CA, Distinguished Economist - Research Consultant (2013-2017)

Lead and conduct economic research and decision support for eBay

eBay Inc, San Jose, CA, Distinguished Economist/Senior Director (2011-2013)

Lead and conduct economic research for eBay Research Labs (eRL)

Lead and support economic analysis for business decisions across the company

Recruit and build a team of economic researchers to grow eRL

Elbit LTD, Haifa, Israel - Sales and contracts manager (1990-1992)

Estimate and analyze costs for small and large scale avionic and optronic military systems.

Prepare and submit management/cost proposals for governments and corporations.

Negotiate proposals and finalize contract clauses with customer representatives.

Elbit LTD, Haifa, Israel - Systems engineer, Avionics (1986-1990)

Prepare technical proposals for avionic systems.

Characterize, design and develop avionic systems and test equipment.

Prepare development and maintenance documentation in accordance with US military specifications.

Expert Testimony and Litigation Consulting Engagements

DZ Reserve v. Facebook, Inc.

California Northern District Court, on behalf of defendant

Paid Search Engine Tools, LLC v. Google Canada Corporation, Google LLC and Alphabet Inc.

Federal Court of Canada, on behalf of defendant

Competition Bureau Canada v. Ticketmaster LLC, TNow Entertainment Group, Inc. and Ticketmaster Canada LP

Competition Tribunal (Canada), on behalf of plaintiff